3.21 SUBSISTENCE

Rural communities in the EIS Analysis Area embrace subsistence traditions as a link to their rich cultural heritage, and as a foundation for today's economy, society, and culture. Based on the testimony of residents from communities potentially affected by the Donlin Gold Project during scoping and the input of tribal cooperating agencies, Section 3.21 describes the context of contemporary subsistence practices, including regulatory environment, the nutritional, economic, social, and cultural dimensions of the subsistence way of life, as well some of the cultural beliefs and values associated with these traditions. The regulatory framework is then presented, followed by a description of current subsistence practices in several highlighted communities throughout the EIS Analysis Area. This is followed by analysis of impacts to subsistence activities by the Donlin Gold Project and alternatives.

SYNOPSIS

This synopsis provides a brief overview of the description of current subsistence practices within the EIS Analysis Area (see Section 3.21.5 for details). Key impact conclusions are noted regarding the proposed action and alternatives, including the Mine Site, Transportation Corridor, and Pipeline components. The Bureau of Land Management (BLM) is required to prepare an analysis under Section 810 of ANILCA as a portion of the construction and operation of the project would take place on federal lands and require BLM permits. The analysis of potential impacts to subsistence in this EIS addresses the ANILCA Section 810 Guidelines along with other important subsistence impact factors. The ANILCA Section 810 analysis prepared for the Donlin Gold Project by BLM is found in Appendix N.

EXISTING CONDITION SUMMARY

During the Scoping meetings for the Donlin Gold Project, Alaska Native residents in the EIS Analysis Area emphasized their desire to protect their cultural traditions and subsistence way of life. The Kuskokwim River is divided into four subregions (Upper, Central, Lower-Middle, and Lower) while five others are found on the Bering Sea Coast, the Yukon River, and in Cook Inlet (see Figure 3.21-1). Each subregion shares a common ecology, a common language, and some common harvest patterns. The description of subsistence harvest patterns focuses on example communities from these nine subregions. Subsistence patterns are described in terms of the seasonal round of harvests of a wide variety of species, subsistence use areas of community-based groups, and sharing practices.

EXPECTED EFFECTS SUMMARY

Construction, Operations, and Closure of the Donlin Gold Mine have the potential for creating adverse and beneficial effects on subsistence resources and practices in the EIS Analysis Area. Potential impacts to subsistence analyzed in this section include reductions in subsistence resource abundance and availability, restrictions on access to traditional use areas, increased competition for subsistence resources (from within and outside the region), and sociocultural changes due to employment, out-migration, and shift work. The nature, intensity and duration of potential impacts will vary by project component, project phase and geographic subregion. Potential mitigation measures,

including specific project design and construction/operations/closure procedures proposed by the applicant, standard state and federal permit conditions, and best management practices have been taken into consideration in analyzing potential impacts.

Comments on the Draft EIS expressed concerns about the potential risk to human health associated with potential exposures to Project-related hazardous chemicals, in addition to those already analyzed in Section 3.22, Human Health. Most of the concerns expressed were associated with consumption of chemicals in food (fish, wildlife, vegetation) and inhalation of chemicals in air. These and other comments were discussed with cooperating agencies during a technical review workshop. As a result of the discussions, a focused risk analysis (FRA) was conducted as part of finalizing the EIS to evaluate the potential risks and hazards of exposure to Project-related hazardous chemicals and is included in Appendix AB, Focused Risk Assessment. A quantitative human health risk assessment (HHRA) was conducted by Environmental Resources Management, Inc. (ERM 2017b) with input from the Corps and AECOM, and is cited in the FRA. The results of the FRA as they apply to potential impacts to subsistence and consumption of subsistence resources are included in this section.

Alternative 1 - No Action

The Donlin Gold Project would not receive permits, and Donlin Gold would not establish the Mine Site, develop the Transportation Corridor, or construct the Pipeline. Key impacts include the return over time of subsistence resources and renewal of earlier subsistence uses by residents of Crooked Creek that may have occurred at the exploration camp vicinity. When exploration and demobilization activities are completed at the current mine exploration site, local residents who were employed there would no longer receive the income from that employment, with associated beneficial effects to supporting subsistence activities. There would be no future mine construction, operations, and closure employment opportunities for local residents that would provide similar benefits.

Alternative 2 - Donlin Gold's Proposed Action

At the Mine Site during Construction and Operations (31.5 years), Crooked Creek residents would see continued displacement of subsistence resources (i.e., moose, black bears, furbearers) and subsistence uses from historic use areas, initiated by exploration activities. Aniak residents would see displacement from a berry picking area north of the Mine Site. Changes would disturb or displace access in limited portions of the subsistence use areas (less than 10 percent of the total traditional subsistence use area). Access to alternative use areas could be available with low additional cost and effort with little change in harvest levels. Concerns and fears of contamination of waterfowl at the Mine Site may affect various subsistence harvest practices by Bering Sea Coast villages within the EIS Analysis Area. Concerns about contamination are reinforced by incidents of contamination of historic mine related pits in other locations of the country, even though biological analysis of this project indicated little risk of contamination. Little increase in competition from mine employees would occur, due to policies for no-hunting and fishing while on shift and the remote enclave workplace approach that would minimize migration to the nearby villages. As an indirect effect, new income and employment opportunities for local residents may support and increase subsistence activities and historic patterns of competition between Kuskokwim River residents for key resources, including Chinook salmon, and moose. In regard to sociocultural impacts, new employment and income would be beneficial, increasing the

ability of households to meet the high costs of subsistence equipment and fuel. An estimated 25-29 percent of EIS Analysis Area households would be affected by project employment during Construction and 8-9 percent during Operations. Based on experience with other large mines in Alaska, about half of employed households may choose to migrate out of the EIS Analysis Area over time, and about half are estimated to find the rotation shift pattern an adverse interference with subsistence activities. After Closure, project activities would cease, and most mine facilities would be reclaimed, recontoured and revegetated. Subsistence resources would return and subsistence uses that may have occurred would generally resume at the Mine Site over time with a few exceptions like the pit lake. Loss of income from project employment may reduce funds available for subsistence activities, and adverse effects of employment induced outmigration and interference from shift work would cease.

Transportation Corridor effects on subsistence resources and access would include loss of small acreages of habitat associated with the port sites, airstrip, and mine access road. Levels of disturbance from river and ocean barge traffic that would affect fish, marine mammals, birds, and terrestrial mammals would generally be limited. However, greater effects could occur in the narrow and shallow segments of the Kuskokwim River, such as near Aniak, Birch Tree Crossing, and the Oskawalik River, where subsistence fishing and moose hunting along the bank could be intermittently disturbed. Fugitive dust from vehicle traffic would affect berry resources along the mine access road. During Construction and Operations, subsistence activities near the mine access road and Angyaruaq/Jungjuk port site would be displaced, affecting residents of Crooked Creek and other Kuskokwim River villages. Redirection to alternative times and use areas at some expense and effort would likely result in little change in harvest levels. Effects on competition and sociocultural features would be the same as those at the Mine Site. After Closure, barge traffic would be reduced, with only a small volume needed to support monitoring and water treatment plant operations at the pit lake. Disturbance to subsistence fish and wildlife resources and displacement of subsistence fishing activities would be minimal.

Along the Pipeline, Construction would disturb 14,100 acres of wildlife habitat along the 316-mile pipeline corridor. Construction activities and noise would affect subsistence resources beyond the pipeline corridor, but would be unlikely to result in reduced abundance of resource that may avoid the area of activity. Access through the active construction area would be limited during construction activities, typically limited to one season per pipeline segment. During Operations (27 years), the buried pipeline right-of-way (ROW) would not be fenced, but would be cleared of trees and shrubs every 10 years to allow for maintenance and visual monitoring. Brush would be cut using a hydro-ax or similar equipment and would be shredded or chipped for use as mulch on the ROW. Little effect on resource abundance or subsistence access is expected. The Pipeline corridor overlaps with portions of the subsistence use areas of Crooked Creek, Stony River, McGrath, Nikolai, Skwentna, and Tyonek. Displacement of subsistence access would be greater during Construction and very limited during Operations and Closure. Increased access for fly-in hunters and trappers associated with improvements at Farewell Airstrip and along the cleared ROW north and west of the Alaska Range could result in a small increase in competition, affecting the residents of McGrath and Nikolai, since their subsistence use areas for large mammals, furbearers, vegetation, and birds overlap with the ROW. The ROW affects small portions of these subsistence use areas, and alternative areas would be available at low additional cost and effort, to achieve similar harvest levels.

The FRA and HHRA evaluated the potential exposure of residents in the vicinity of the mine operations to baseline and mining generated levels of mercury, arsenic, and antimony as the result of consumption of representative subsistence resources. The evaluation assessed the cancer and non-cancer risks of potential exposure to these chemicals. As representative subsistence resources with greater potential for exposure to and accumulation of potential chemical contaminants, the FRA and HHRA evaluated potential effects of consuming northern pike, beaver, mallard ducks, and berries. The analysis used recent regional per capita subsistence consumption estimates for these resources (Brown et al, 2012) and the conservative (upper-bound) assumptions included that the potentially affected residents of Crooked Creek and Georgetown harvested all of these resources consumed within a 20 mile radius of the mine site and consumed all of the resources harvested, and used the regional average consumption rate per capita that was consistently higher than the Crooked Creek rate. The results of the analysis concluded that in the area of analysis, exposure to mercury at baseline and estimated project levels would be below the advisory levels of both the Environmental Protection Agency (EPA) and State of Alaska Environmental Public Health Program. For arsenic, exposure at baseline and estimated project levels are within EPA's acceptable risk management range.

Overall, the findings of the quantitative HHRA indicated that the small increases in constituent concentrations estimated to occur outside of the Mine Site due to Project-related activities are unlikely to result in unacceptable risks to human populations who would have the highest exposure (i.e., subsistence users). Based on these findings, other human populations, such as other residents in the region, would not be expected to be exposed to unacceptable risk due to exposure to Project-related concentrations of mercury, arsenic, or antimony. However, potential mitigation measures associated with monitoring of mercury levels in fish tissues have been expanded in Chapter 5, Impact Avoidance, Minimization, and Mitigation. For more detail, see Section 3.21.6.1.2, Section 3.22.4, and Appendix AB.

OTHER ALTERNATIVES

This section discusses differences of note between Alternative 2 and the following alternatives, but does not include a comprehensive discussion of each alternative's impacts if they are the same as or similar to Alternative 2 impacts.

Alternative 3A - LNG Powered Trucks

For the Transportation Corridor, the project river barge frequency would be reduced from 122 barge tow round trips per year under Alternative 2 to 83 trips, due to reduction in diesel fuel barging. This would proportionally reduce the disturbance impacts to fish and subsistence fishing, with particular importance in the shallow and narrow reaches of the Kuskokwim River.

Alternative 3B - Diesel Pipeline

For the Transportation Corridor, the barge frequency would be reduced from 122 annual barge tow round trips under Alternative 2 to 64 trips due to the elimination of diesel fuel barging. This would proportionally reduce disturbance and displacement impacts to fish, particularly in shallow and narrow reaches of the Kuskokwim River. External competition for subsistence resources in the vicinity of the pipeline due to increased access would be an important effect, since the supporting infrastructure for construction, including nine new airstrips and gravel access roads would remain in place during the Operations

Phase to provide spill response capabilities. Helicopter surveillance, every two weeks, across the entire pipeline during Operations could disturb wildlife and interfere with subsistence hunting activity along the pipeline. The expansion of the dock near Tyonek to receive diesel tankers would affect near shore habitat, and 12 diesel barge deliveries per year may result in disturbance to marine mammals if they are present when barges are present (see Section 3.12, Wildlife, for details on marine mammal populations in the EIS Analysis Area, and Section 3.14, Threatened and Endangered Species, for details on ESA-listed marine mammal populations in the EIS Analysis Area).

Alternative 4 - Birch Tree Crossing (BTC) Port

For the Transportation Corridor, the barging distance would be reduced from 199 river miles to 124 river miles to avoid the generally more narrow reaches of the river above Birch Tree Crossing (BTC). The BTC port would affect hunting for moose, black bear and waterfowl hunting, and berry picking in a small portion of Central Kuskokwim village use areas along the river corridor. The mine access road would increase from 30 miles long to 76 miles long, resulting in an additional 46 miles of impacts to subsistence resources, and disturb subsistence resources and uses for portions of Aniak and Chuathbaluk use areas for moose hunting and berrypicking. Subsistence effort could be redirected to unaffected portions of the use areas at small cost and effort.

3.21.1 THE MANY DIMENSIONS OF SUBSISTENCE

Alaska Native groups in the EIS Analysis Area speak two distinct Alaska Native languages: Yup'ik and Athabascan as detailed in the cultural history discussion in Section 3.20. Historically, the border between the Yup'ik and Athabascan cultures was dynamic. Through the late 18th century, the Central Kuskokwim area was occupied by two distinct groups of Athabascans: the Dena'ina, and Deg Hit'an. In the early 19th century, Yup'ik speaking people from the coast moved into the Central Kuskokwim (CL Brown et al. 2012). Within the EIS Analysis Area on the upper Kuskokwim River above Swift River are the Dichinanek' Hw'tana (or "timber river people") (Collins 2004), also known as Upper Kuskokwim Athabascans. The Deg Hit'an inhabit the Central Kuskokwim, the lower reaches of the Innoko River, and lower Middle Yukon as far as Anvik. Above the Deg Hit'an on the Yukon River are the Holikachuk people who currently inhabit the community of Grayling (Snow 1981). The Dena'ina also occupy the western side of Cook Inlet, notably in the community of Tyonek.

Historically, the culture and economy of both Yup'ik and Athabascan societies revolved around subsistence or harvesting food from the land. Starting in the late 19th century these traditions have adapted to rapid change beginning with devastating epidemic diseases, development of a cash economy, and later, beginning in the middle of the 20th century, to population growth followed by competition over subsistence resources. Alaska Natives have faced challenges to maintain access to their traditional lands and subsistence activities. During the land claims movement of the 1960s, Alaska Natives created regional and statewide organizations in an effort to protect their traditional patterns of land use, including the subsistence lifestyle. As a result, of their advocacy, legislation to protect subsistence practices was passed by the Alaska Legislature in 1978 and the U.S. Congress in 1980. More detail on the legal and regulatory context is provided in Section 3.21.3.

Although the protective subsistence legislation represents an important achievement of the land claims movement, it should be pointed out that many Alaska Natives do not like the term subsistence, feeling that it does not adequately describe the importance of wild foods to Alaska Native culture. As the Gwich'in Athabascan elder, Jonathan Solomon said:

> ...You cannot break out subsistence or the meaning of subsistence or try to identify it, and you can't break it out of the culture. The culture and the life of my Native people are the subsistence way of life. ... It goes hand in hand with our own culture, our own language, and all our activities (quoted in Berger 1985).

To describe the holistic nature of subsistence is to say that subsistence is important for nutritional, economic, social, spiritual, and cultural reasons. Nutritionally, locally available wild resources are often superior to imported processed foods. Looking at rural Alaska as a whole, the annual harvest of 295 pounds of wild food per person contains 189 percent of the protein requirements of the rural population and 26 percent of the caloric requirements (ADF&G 2014d).

Wild foods have considerable economic value as part of the modern mixed economy of rural Alaska, and can be supplemented by income derived from wage employment. The subsistence economic sector is both cash dependent and highly cash efficient, resulting in large volumes of highly nutritious, culturally valued foods for modest investments of cash. The estimated "replacement value" of the annual harvest of wild foods in rural Alaska is between $147 and $295 million (ADF&G 2014d). Employment opportunities and cash incomes are scarce in rural communities, and generally provide a modest basis to pay bills and to purchase and maintain equipment, such as boats, motors, snowmachines, guns, and subsistence fishing gear, and to pay for the operating costs of subsistence activities including ammunition and gasoline to access subsistence harvest areas. In western Alaska, economic linkages between villages and the wider world include wages earned by commercial fishing, seasonal labor, some full-time employment, and transfer payments from governments and other entities such as ANCSA corporations.

While the harvest and use of wild foods can be measured quantitatively in terms of nutritional and monetary value, many Alaska Native people see wild foods and the subsistence way of life as priceless. A woman from Port Graham put it this way:

> I don't [know] how anybody...who can place the value on my Nativeness, who can place a value on my thinking, my spirituality, I don't think anybody can. Only myself, and I think each and every one of us need to remember that we are Native and that we need to value that and protect it... through protection of our lands and our lifestyle (quoted in Berger 1985).

Modern technology, while dependent on cash incomes, has increased people's ability to harvest what they need in less time.

> They had to fish as long and as much as they could [in the past]. Today without equipment, with the modern equipment we have today, we don't need as much time to get as much fish as we need. So that's, some families will quit fishing within two weeks, some within a month. When I was a boy people would be fishing most of the summer until middle of July, end of July sometimes (quoted in Ikuta et al. 2013).

Time and money spent on harvesting wild resources can be adjusted depending on need, opportunities for wage labor, and success of recent wage employment, such as commercial fishing. But the investment in money is less important than the hunter's very large investment

in time/labor or hardship and risk, and it does not alter the fundamental nature of the enterprise. Many rural residents in Alaska do not distinguish conceptually between subsistence and cash elements of the same activity. In villages with a history of commercial fishing, for example, commercial fishing and subsistence fishing occur at the same time and they complement each other, both money and fish are vital to the mixed economy of the village. A more extensive discussion of the relationship between employment, income, and subsistence production is found in Section 3.21.6.1.3, in the subsection Changes in Employment and Income.

While many people are able to integrate subsistence activities and wage labor, economic pressures have forced people to make compromises. During the summer when jobs are available, people have to make choices between working and fishing as reflected in this statement by a resident of Tuntutuliak.

> Cause most of the jobs are for the summer. Weatherization, boardwalk making, so half the men will be working, probably weekends will be the only option for people who are working. Weekend will be Saturday, weather permitting. So everything is getting tighter. Work. Everything going up. Most men will probably try to be working, fishing season or not. They have no choice. Wintertime – how will they do it? How will they provide for stove oil, lights? If they're thinking about that, then it'll probably be mostly weekends that they'll be fishing, from my understanding (quoted in Ikuta et al. 2013).

In addition to nutrition and economics, a third dimension of subsistence is social and cultural, encompassing both the social organization and spiritual aspects of Alaska Native life. Harvesting subsistence resources in many cases requires cooperation by several individuals and households, and this cooperation helps knit together cohesive societal units. The shared labor of producing and processing subsistence foods creates and maintains enduring social bonds within kin groups; between men and women, and between elders, adults, and younger people. In this respect, subsistence provides a crucial link between the modern sociocultural systems and their roots (Berger 1985; Nelson 1983).

The traditional society is based on subsistence activities that link generations and the extended family into a rich network of associations, rights, and obligations. The network reflects and re-creates the social order and gives meaning and value to each person's contribution and rewards. The distribution of wild foods to other households throughout a community establishes or further defines the relations of mutual aid and obligation among components of a society, as well as providing increased security in a very challenging natural setting (ADF&G 1990). Leaders are men and women who provide for the needs of others; good hunters share their harvest and are often identified as leaders. In many communities, a small number of families (or households) ultimately harvest the vast majority of subsistence resources (Wolfe 1987). Research shows that 30 percent of households often supply 70 percent of the subsistence foods.

Subsistence foods are also frequently central components of important ceremonies, such as the winter ceremonials practiced by the Yup'ik of southwest Alaska (Fienup-Riordan 1983, 1990a, 1994) and the Northern Athabascan potlatch (AM Clark 1981; Simeone 1995). The harvest, preparation, and sharing of food is a central feature of these ceremonies, which express and recreate for new generations the central cultural values of respect for the natural world, avoidance of waste, and generosity with the foods that the animals provide.

3.21.2 SUBSISTENCE VALUES AND BELIEFS

In addition to special skills and knowledge needed to live directly from the land, the subsistence way of life also involves cultural values and attitudes: mutual respect, sharing, resourcefulness, and an understanding—that is both conscious and mystical—of the intricate relationships that link humans, animals, and the natural environment. Because Alaska Native groups continue to define themselves to a large degree by the customs and traditions in obtaining, processing, and distributing wild resources, they see the maintenance of these cultural traditions and values as an essential element of their subsistence activities (de Laguna 1969-70; Nelson 1983; Fienup-Riordan 1994; Simeone and Kari 2002).

One important aspect of these traditions is a system of environmental stewardship or self-regulation embedded in local practices and knowledge, evidenced in worldview, property rights, social authority, and the definition of the sacred. Traditional regulations or rules govern all subsistence activities, and are set in place to insure the annual return of the animals and fish. Traditionally based rules govern both the moral and practical behavior of the harvest.

These rules are not arbitrary or illogical but derived from a religious or cosmological tradition passed down orally and based on the belief that all animals are sentient, social beings who freely give themselves to humans, but only if humans treat them with respect (de Laguna 1969-70; Nelson 1983; Fienup-Riordan 1994; Simeone and Kari 2002). The principal of respect governs all relations among beings in the cosmos, and is maintained through proper cultivation, interaction, and stewardship. A man from Oscarville put it this way,

> If you catch them [birds], you got to eat them, bring them home. You don't just throw them around anywhere. You treat them like they are actual people (quoted in Brown et al. 2013).

The rules governing the relationship between humans and animals are based on a mythic charter or set of oral traditions that provided the fundamental guidelines or instructions for how humans are to engage with animals and their environment (Langdon 2003; Simeone and Kari 2002). This belief is the basis for the Alaska Native system of stewardship or self-regulation.

The term "engagement" is fundamental to understanding the Alaska Native conception of their relationship with the environment and the animals that human beings depend on to live. Alaska Native people demonstrate respect for the animals and the environment through a variety of actions that encompass every aspect of the harvest, from talking and thinking about animals, to handling animals, to construction of fish weirs, fish racks and other equipment, to sharing the harvest, and welcoming the retuning animals with song and ceremony. By following these rules, Alaska Native people believe they ensure an abundance of animals, fish, and plants. This relationship has been called collaborative reciprocity (Fienup-Riordan 1994), or relational sustainability (Langdon 2003). It is through good relations that human beings and the animals and plants they depend on for survival are sustained over time.

Relational sustainability is based on the principle of maintaining a respectful relationship between humans, animals, and the land. To show respect, humans must first be aware of themselves and the world around them. Children are told to be observant of all things, but especially when it comes to fishing.

> ...the elders used to tell them not to ignore anything, to be observant, and one thing was when one was traveling by canoe or kayak, they'd see fish behaving unusually, they were told to observe that fish because, you know, some of the behavior that the fish display can tell you how it's going to be in the wintertime or when it gets to a certain time of the year, something is going to happen, or it could be a sign of a storm or something good (quoted in Ikuta et al. 2013).

To be aware is to be cognizant of your actions. The intimate connection between humans and animals is reflected in the idea that it is not only important how human beings act but also how we think about animals. The spoken word can have a powerful effect. For example, it is important not to complain or argue about fish or to brag about fishing success because these actions prevent the return of fish.

> And there's a saying that when people are saying bad things or talking mostly about them in a bad way or saying it's for them only, not for outsiders, the numbers [of fish] go down. And when they say it with everybody there, the abundance or quota will go down, surprising (quoted in Ray et al. 2010).

> Right after they started complaining about the fish, I noticed a decline in their number. That's what our elders tell us, not to complain, like they're doing, not to be stingy with other people, but to share that area with everyone, that's how we are... when they do that [be stingy]... the fish knows about their intentions and they don't want to thrive in their area anymore (quoted in Ray et al. 2010).

Children are taught to show respect in order to be successful hunters and providers.

> That's why...our elders used to respect the ground. They just don't want to mess it [up]. Even with the hunters, [they] have got to be trained by the elders to respect everything, even the ground where the plants... You just want an environment the way this [is], you just wanna not disturb the ground, you know. The plants and the river for the fish. That's how I grew up. That's how I was taught by one of the elders, too (quoted in Ray et al. 2010).

Another elder put it this way:

> ...if you don't take care of the fish or animals you'll be, ah – not a nukalpiaq, not a good hunter. Every time you'll go out bird hunting you'll catch one bird while others are catching more – because you don't take care of 'em, it's that way...He provides. If we take care, He'll provide more. Don't be stingy, share... (quoted in Ikuta et al. 2013).

To show respect for the animals, plants and fish, human beings must follow certain rules including: regulating their harvest or taking only what they need, timing the harvest, skillfully preparing the harvest, avoiding waste, and sharing the harvest.

Regulating the harvest: Yup'ik elders in Eek said that self-limiting the harvest was a fundamental aspect of traditional management. For example, people limit their blackfish harvests and trap only what they need. As one elder explained, when they're trapping for blackfish, sometimes when you catch too many, they just pull them [the traps] out a while" (quoted in Ray et al. 2010).

An Athabascan resident of Nikolai explained that when harvesting salmon in the past they put in a fish trap, but never harvested all of the fish in the run.

> We just doing it for our own use, subsistence, what we use. And that's what we get. When it's enough, enough. Even still more fish, but sometimes we quit early. Soon as our smokehouse even started getting full, we just pulled the fence out, the fishtrap. Threw it in the bank. And all the fish go by (quoted in Ikuta et al. 2013).

Yup'ik also explained that they might voluntarily limit their harvests for one year following a loss in the family, as this is a period of spiritual vulnerability and risk of environmental mishap.

> When a person do that [seal hunting or fishing in the year following a family loss] there's always big waves. And some big chunk of ice moves. That's what happened to us. One of our relatives went down. Wife had a miscarriage. Almost lost our snow machine. Even we lose our sleds. It's not safe (quoted in Ray et al. 2010).

Timing the harvest: Harvest timing is an important element in self-management because successful subsistence economies rely on efficient seasonal harvest practices. Hunters and fishers report timing their harvest activities to periods when animals and fish are abundant and in their prime. For example, communities along the Kuskokwim River reported harvesting whitefish in the fall when they are fat and accessible in relatively greater numbers. Burbot and ciscoes are also harvested during the fall because they taste better when it is cold. "In the spring time we just leave them alone. We don't care to fish for them because we know the meat is not right" (quoted in Ray et al. 2010).

The weather can have an enormous effect on the salmon preservation process, and several people [from Tuntutuliak] explained that this is one reason why there was so much controversy over the regulated closures and fishing windows of the 2000s. Good fishing weather is breezy, but not too windy, and clear – because the fish will dry much faster on sunny days. Fish preserved in poor weather are definitely of lower quality. Without an enclosed smokehouse and a constant low fire, fish that are hung in rainy weather do not dry well and can be ruined (Ikuta et al. 2013).

> When weather's bad people even stay out to protect their fish from spoiling – they watch 'em. They didn't have plywood or something on top of the racks, the fish racks them days. They covered the fish with anything they can use to protect them to keep good fish (quoted in Ikuta et al. 2013).

Drying fish in rainy weather produces an inferior product, and the investment of effort is much riskier. "When the weather is no good, we don't go out fishing. We don't want to spoil the fish from the rain." Too much heat spoils the fish too, "when it gets really hot and there's lots of flies we have to watch, watch the fish that we have and make sure they won't try to spoil them, you know those little maggots. Make sure they don't – we have to take them off" (quoted in Ikuta et al. 2013).

Preparation of the harvest: Rules for preparing the harvest apply to all animals. Recent research in the EIS Analysis Area has focused on salmon and other fish, so this description emphasizes the treatment of fish. Preparing salmon is an important job that can affect both the future abundance of the fish and the success of the fishers. When Yup'ik elders in Tuntutuliak were asked how they made sure the salmon would come back, they reported techniques for proper preparation and preservation of the fish – emphasizing respectful treatment rather than fishing strategies that encourage conservation (Ikuta et al. 2013).

Knowledge of how to care for the fish is passed from generation to generation. It is important to teach younger people how to prepare fish so that they do not spoil. Elders stressed "the

importance of caring for the fish so they don't spoil, so that they stay abundant" (quoted in Ikuta et al. 2013).

At a recent meeting in Aniak an elder from Crooked Creek stressed the importance of teaching young people subsistence skills so they could feed themselves, even if they had jobs.

> Subsistence way of life is so important to our family, that even my grandkids that were raised in the cities, they come home in the summer to help us with our fishing and the fall time for our hunting. They have learned our ways because they need to know how to feed themselves should it ever come to that (URS 2013c).

There is concern among some elders that people are no longer following the rules and that this may be one reason why fish are no longer as abundant as they once were.

> People are not watching their fish and their tools as good as they used to, as well as they used to, like sometimes they would find a piece of fish that had been chewed on or carried away by dogs. Those types of things are happening today sometimes... Some people are getting careless about the ways they take care of their fish, their supplies, and their tools. At some point fish became less abundant (quoted in Ikuta et al. 2013).

Avoiding waste: A fundamental principal of responsible preparation is not to waste fish. Once caught, fish must be worked on promptly. To ensure quality "no more fish are taken than can be cut within 24 hours, and usually no more than can be processed that day" (Ikuta et al. 2013). A Yup'ik elder in Tuntutuliak explained that,

> They never used to throw any guts out except for that part there. They keep the fish roe, hang it up, dry it up, and the liver they used for stinkheads. And that thing, the stomach part, the throat part, they used to braid it and then hang it up for dry. They used to hang the hearts too, dry 'em up (quoted in Ikuta et al. 2013).

An Athabascan elder in the upper Kuskokwim community of Nikolai said "we did not waste fish, we kept what we wanted, and we store it, that is the way" (quoted in Holen et al. 2006). Another Nikolai elder "You can get as much as you want to use. If bones aren't burned that is how it gets lonely, the birds or fish or whatever, getting caught less and less, everything" (quoted in Holen et al. 2006).

Sharing the harvest: Generosity in sharing food is critical for ensuring proper social relations within a community, and for ensuring proper relations between human beings and their environment. Research on sharing in subsistence-based communities indicates that large segments of a community are bound together through sharing (Magdanz et al. 2011). Sharing is to be done discreetly and not boastfully. Generosity will be rewarded. Yup'ik elders in Tuntutuliak said that sharing would cause people to be blessed and successful in subsistence activities. There is an understood belief that hoarding fish without sharing with those around you will bring consequences in regards to fishing.

> The other issue if you're stingy and don't share, you won't be able to get as much, if you don't share you won't be able to be as productive. The more you share, the more you get. Everybody was taught that right from the beginning (quoted in Ikuta et al. 2013).

There are particular rules regarding the sharing of the harvest. For example, after a young person makes their first harvest it is customary for the animal or fish to be shared with the elders. A man from Crooked Creek explained:

> When I got my first marten I asked my mom if I could give it to one of the elders. She said that was the tradition, that I give it to one of the elders. If you get something, you give it away (quoted in CL Brown et al. 2012).

In many communities, there were special rules and rituals surrounding the harvest of the first salmon. In Nikolai, for example, people gathered to share the first harvest and dance.

> ...people would cook it up and eat it together, all sharing. I saw one time a sort of Eskimo dance when I was a kid. But they stopped that. But they used to get together quite a bit and they talked about how they lived long ago. How to take care of your food, don't throw anything away, don't waste.... what they do in the wintertime, like Christmas, everybody cook, put lotta things together, then they got together and eat together. And what they do after that, then old people tell'em stories about how they used to live long ago....Most of what that was about how to take care of your food. Don't throw anything away that you wouldn't take care of, don't waste nothing, that's how it used to be... Here I'm still that way, even today (quoted in Holen et al. 2006).

In summary, the subsistence way of life is a holistic cultural practice, integrating harvest activities with values and beliefs essential to community survival. Traditional values embedded in relational sustainability establish respectful relations between humans, animals, and the land. Subsistence harvests structured through long-established environmental stewardship customs endure in conjunction with the regulatory environment described in the next section.

3.21.3 REGULATORY ENVIRONMENT

Hunting, fishing, and gathering were the primary economic activities for all Alaska Natives up until the middle of the 20th century, and remain important in these communities today. At statehood in 1959, the State of Alaska gained authority for managing fish and wildlife from the federal government. State control of fish and wildlife was a leading argument for statehood since many Alaskans viewed federal management as favoring outside interests and being unresponsive to local needs. The Alaska Constitution established that fish and wildlife "are reserved to the people for common use" and that "no exclusive right or special privilege of fishery shall be created or authorized" (Alaska Constitution, Article 8, Sections 3 and 15).

Subsistence had surfaced as a major focus of the Alaska Native land claims movement, which resulted in Congress passing ANCSA in 1971. The act addressed Alaska Native land claims that had clouded title and delayed conveyance of lands under the Statehood Act, and had also delayed construction of TAPS from the North Slope. ANCSA extinguished aboriginal title, including aboriginal hunting and fishing rights in Alaska in exchange for almost $1 billion in cash and 44 million acres of land transferred to Alaska Native Corporations; but Congress expressed the intent that the Secretary of the Interior would work with the State of Alaska to protect modern Alaska Native hunting and fishing. By the mid-1970s, Alaska Natives lobbied Congress for more specific protections of their subsistence activities.

While subsistence legislation was pending in Congress, in 1978 the Alaska Legislature adopted its first subsistence law, building on provisions since statehood, in which Alaska's regulatory system had managed subsistence separately from recreational and commercial harvesting. The 1978 state law defined subsistence as "customary and traditional uses" [AS 16.05.940 (33)] of fish and wildlife, thereby highlighting the continuing role of subsistence fishing and hunting in sustaining long-established ways of life in the state. Under this law, subsistence was established as the priority consumptive use of fish and wildlife resources (now AS 16.05.258).

In 1980, Congress fulfilled the promise to protect subsistence when it passed ANILCA. Besides creating new national wildlife refuges, parks, and public recreation lands, Title VIII of ANILCA provided a definition of subsistence, a priority for subsistence uses on federal lands, and provisions for participation of subsistence users through regional advisory councils.

Under a concept of "cooperative federalism," Title VIII provided that so long as the State of Alaska implemented a compatible program, the state would implement a unified subsistence management program on all lands and there would be no separate federal management of subsistence on federal lands (CFR Title 36, Part 242 [36 CFR 242.1] or CFR Title 50, Part 100 [50 CFR 100.1]).

The state took note of the discrepancy between the various laws and amended state law in 1986 to match ANILCA by limiting subsistence uses to rural residents. However, in 1989, the Alaska Supreme Court ruled in McDowell v. Alaska (785 P.2d 1 [Alaska 1989]) that the rural preference violated the Alaska Constitution, including its "common use" provisions regarding use of fish and wildlife. This meant that the State could not give a priority to a person based on where they lived. In essence, the Alaska Supreme Court's decision meant that under Alaska's subsistence law, the subsistence hunting and fishing priority was open to all Alaska residents.

Because Alaska law no longer provided for a "rural" priority in conformance with federal law, the federal government moved to take over management of subsistence on federal public lands in 1989. Several attempts by the State to reconcile the two laws by amending the Alaska Constitution failed when supporters could not muster enough votes in the Alaska Legislature to send a constitutional amendment to Alaska voters for ratification. Federal managers took over authority for subsistence management on federal lands on July 1, 1990, creating divided management of subsistence. This means that different definitions of the subsistence priority apply on state versus federal lands.

Management of subsistence fisheries emerged as a matter of further controversy. In a series of cases consolidated as Katie John, et al. v United States, Alaska Native plaintiffs argued that ANILCA's term "public lands" included navigable waters where most subsistence fishing occurred. This complex litigation came to conclusion in 1995, when the Ninth Circuit Court of Appeals concluded that federal jurisdiction extended to "reserved" navigable waters only, meaning those on or adjacent to federal lands. The U.S. Supreme Court declined to review this decision and after a moratorium on implementation to allow additional time to the Alaska Legislature to come into compliance with the ANILCA requirements, the federal subsistence program expanded to fisheries in these reserved navigable waters in October 1999. Federal and state law use substantially the same language regarding the definition of subsistence, with minor wording differences in the clause regarding barter, sharing, and trade (16 U.S.C. §3113). The main difference between federal and state regulatory definitions is that federal law gives a preference to rural Alaskans, whereas state law allows no such preference.

3.21.3.1 STATE REGULATIONS

Under state law subsistence uses "means the non-commercial, customary and traditional uses of wild, renewable resources by a resident domiciled in a rural [sic] area of the state for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for making and selling of handicraft articles out of non-edible by-products of the fish and wildlife resources taken for personal or family consumption, and for customary trade, barter, or sharing

for personal, or family consumption" (AS 16.05.940[33]). All residents of the state are defined as "subsistence users" (AS 16 and 5AAC 99).

State law protects customary and traditional uses of fish and game resources and the state must provide for those uses before providing for recreational or commercial uses. To decide if a fish stock or game population is associated with customary and traditional uses, state regulation 5 AAC 99.010 directs the Board of Game and the Board of Fish to examine eight factors.[1] Under current Alaska subsistence regulations, if a resource is sufficient to support all uses, then Alaska resident and non-resident hunters may participate. If the resource abundance is sufficient to support only Alaska resident subsistence hunting, all Alaska residents must have an opportunity to take that resource, and non-Alaskan uses are restricted. This is referred to as the Tier I process. If the resource abundance is not sufficient to accommodate all Alaska residents, then under state management, all residents may apply for one of the restricted permits under the conditions of scarcity in the Tier II process.

Two boards make regulations for all hunting and fishing, including subsistence: the Board of Game (BOG) and the Board of Fish (BOF). Each board consists of seven members serving 3-year terms; the governor appoints board members, and the State Legislature approves the appointments. Proposals to change subsistence regulations may come from members of the public, the Department of Fish and Game, or the Boards themselves. About 80 Local Fish and Game Advisory Committees statewide advise the Boards. The Division of Subsistence, which was created under the 1978 subsistence law, has the responsibility of providing the boards with information and harvest data about subsistence activities.

Fish and game management in Alaska is organized by geographic areas. There are 26 Game Management Units (GMUs) in the state with numerous subunits, and special management, controlled use, and closed areas. Fisheries management is organized by regions and areas, districts, and subdistricts within the districts, depending upon whether there is commercial, sport, or subsistence and personal use management. The federal management system has largely adopted the geographically based GMUs and fisheries management areas. Most of the EIS Analysis Area is within GMUs 16, 18, 19, and 21, and the Kuskokwim management area.

3.21.3.2 FEDERAL REGULATIONS

The federal subsistence law is found in Title VIII of ANILCA and the implementing regulations are at 36 CFR 242.1 and 50 CFR 100.1. As defined in ANILCA Section 803,

> … the term "subsistence uses" means the customary and traditional uses by rural Alaska residents of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade. For the purposes of this section, the term—
>
> (1) "family" means all persons related by blood, marriage, or adoption, or any person living within the household on a permanent basis; and

[1] 5 AAC 99.010 Boards of fisheries and game subsistence procedures (AAC-Alaska Administrative Code).

> (2) "barter" means the exchange of fish or wildlife or their parts, taken for subsistence uses—
>
> (A) for other fish or game or their parts; or
>
> (B) for other food or for nonedible items other than money if the exchange is of limited and noncommercial nature.

The federal subsistence management program is organized as a multi-agency program that works cooperatively with rural Alaskans to develop regulations through Regional Advisory Councils and the Federal Subsistence Board. It is administered principally through the USFWS, Office of Subsistence Management. The voting members of the Federal Subsistence Board include the Alaska directors of the USFWS, NPS, BLM, BIA, the USDA Forest Service, plus a Chair and two subsistence community representatives appointed by the U.S. Secretary of the Interior and the Secretary of Agriculture.

For federally managed subsistence uses on federal lands, the eight-member Federal Subsistence Board establishes subsistence regulations. The Board receives recommendations on regulations from 10 Regional Advisory Councils distributed across Alaska. The Federal Subsistence Board is required to give deference to the recommendations of the Regional Advisory Councils and can reject a recommendation only if it is detrimental to the satisfaction of subsistence needs, violates recognized principle of fish and wildlife conservation, or is not supported by substantial evidence. Proposals to change regulations may be made by federal staff, members of the public, Regional Advisory Councils, or by the Board itself.

The refuge manager for the Yukon Delta National Wildlife Refuge is the in-season manager for federal subsistence fisheries on the federal waters of the Kuskokwim River pursuant to delegation of authority from the Federal Subsistence Board.

Subsistence activities involving federally managed migratory species are governed by other laws, including the Marine Mammals Protection Act (MMPA) and the Migratory Bird Treaty Act (MBTA). The harvest of marine mammals is restricted to Alaska Natives by federal law. Within the EIS Analysis Area, the National Marine Fisheries Service (NMFS) manages the Cook Inlet beluga stocks and the USFWS manages walrus in Kuskokwim Bay. In both cases, the agencies cooperate with Alaska Native co-management bodies, such as the Cook Inlet Marine Mammal Council (CIMMC) and the Alaska Native Migratory Bird Co-Management Council.

As detailed above, federal law defines "subsistence" as the customary and traditional uses by rural residents of fish and wildlife and other renewable resources for food, clothing, shelter, and handicrafts.[2] So, as in state law, federal law defines the subsistence use of fish and wildlife resources based on customary and traditional use patterns. The Federal Subsistence Board determines which communities are rural, and then which communities have a pattern of customary and traditional use for particular fish stocks and wildlife populations. Additional provisions and determinations apply to subsistence uses on NPS lands. The Federal Subsistence Board uses eight factors to determine customary and traditional use, very similar to those used by the state.

[2] Section 803 Definitions in ANILCA P.L. 96-487 (ANILCA-Alaska National Interest Lands Conservation Act, as amended).

Section 810 of ANILCA requires that an evaluation of subsistence uses and needs be completed for any "withdraw, reserve, lease, or otherwise permit the use, occupancy or disposition of public lands." The guidelines under Section 810 identify three types of potential impacts:

1. Restrictions of subsistence uses due to reductions in abundance or availability of subsistence resources resulting from habitat loss, environmental pollution, direct mortality, and disturbance and alteration of their normal locations or migration patterns;
2. Restrictions of subsistence uses due to reduced or restricted access to formerly used harvest areas, including physical and legal barriers; and
3. Restrictions of subsistence uses due to increased competition for subsistence resources. This can include competition from non-local workers associated with the project, but also changes in subsistence uses by rural residents, increasing competition in some areas.

A portion of the construction and operation of the Donlin Gold Project would take place on federal land and require permits from the BLM. Therefore, BLM is required to prepare a subsistence analysis under ANILCA Section 810. This analysis is found in Appendix N.

3.21.4 TRADITIONAL ECOLOGICAL KNOWLEDGE

In the last three decades, Alaska Natives have effectively advocated for recognition of their complex bodies of knowledge and understanding about climate, weather, landscapes, migratory patterns, animal life histories, and seasonal distributions. This traditional ecological knowledge (TEK) is just as important as modern means of transportation and hunting technology in supporting safe and efficient subsistence harvest activities.

Usually associated with indigenous societies, TEK can provide a source of insights from people intimately familiar with their surroundings. These insights can be useful for the assessment of environmental impacts. However, a major challenge to researchers and decision-makers is how to integrate the two sources of knowledge (TEK and scientific measurement) in a meaningful and productive way (Huntington 1998).

As urged by stakeholder and tribal cooperators, an inclusive approach to TEK is taken here. In recent scholarship, different definitions emphasize different facets. Berkes (1999) defines TEK as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environments." For Berkes, traditional knowledge involves both objective knowledge and cultural beliefs. Huntington (1998) defines TEK as "the system of experiential knowledge gained by continual observation and transmitted among members of a community." This definition emphasizes the observational knowledge accumulated as traditional knowledge, and this body of ecological information has the potential to augment the empirical observations of Western science. Considering the various definitions, it is important to recognize that TEK encompasses both the observational knowledge and the values and beliefs that give meaning to these observations within the cultural context of specific indigenous communities passed down through time and many generations.

Pierotti and Wildcat (2000) write that traditional knowledge is inherently multidisciplinary.

> It not only forms the basis for indigenous concepts of nature but also for concepts of politics and ethics. There are therefore no clearly defined boundaries between philosophy, history, sociology, biology and anthropology in indigenous thought.

This larger conception is often termed Traditional Ecological Knowledge and Wisdom, or TEKW. Some of the characteristics of this way of thought are that it is:

> Inherently local and practical, focused on finding food and other resources in specific environments.
>
> Based on observations of very specific localities, over a long period of time. Long-time observations of this sort can be very discriminating in detecting changes and may be seen as comparable to "trend indicators" in Western science. This may be misunderstood, or dismissed by some, as merely anecdotal.
>
> Unlike Western science, which develops discrete analytic categories of study, traditional knowledge is holistic and cumulative. That is, a local person's view of their environment is frequently shaped by a wide variety of factors, including observed changes in resources, but also the circumstances of competition over resources, regulation, and history.
>
> Traditional knowledge is set within a value and belief system about proper relations between human and the natural world. In the indigenous cultural paradigm animals are considered nonhuman persons possessing awareness and meriting respect (Fienup-Riordan 1994).

The study of TEK has been vigorously advocated by Alaska Natives, who insist that their accumulated knowledge of the lands in which they live, of the plants and animals that they harvest, and of the changing physical environment should be recognized as equally valid to that knowledge gained through western scientific methods.

Resource managers have started to gather and integrate TEK into research programs and co-management plans and partnerships. An early Alaskan example is the development of the Alaska Eskimo Whaling Commission and North Slope Borough support for gathering TEK from Alaskan Native whalers. Their knowledge was needed to counter the estimates of low bowhead whale numbers that moved the International Whaling Commission (IWC) towards a complete ban on subsistence whaling. Additional data, including the observation of the Alaska Eskimo whaling captains, presented to the IWC in the years following 1978 led to a quota of allowed strikes and harvests. Historical information justified the allocation to meet the cultural and subsistence need. Rigorous bowhead whale census and other biological and behavioral studies were combined with the TEK of whalers showing that more bowheads were present than previously believed. The resulting cooperating management regime, involving NMFS and the Alaska Eskimo Whaling Captains has contributed to bowhead conservation and population recovery, while providing for a sustainable subsistence whaling program, (Braund and Moorehead 2009; NMFS 2013d).

More recent research initiatives on the Kuskokwim River have included TEK studies as an integral part of strategies to develop fuller understandings of complex fisheries ecosystems and to promote direct participation of the largely Alaska Native communities that rely on these resources. In 1999, the Federal Subsistence Board established the Fisheries Resource Monitoring Program in which funding was directed to stock assessment, subsistence harvest assessment,

and TEK studies. Starting in 2002, the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative began a broad-ranging research effort to understand the ecosystem dynamics behind declines in western Alaska salmon populations. This program too, partnered with Alaska Native and tribal organizations to integrate TEK into the research agenda and to create the basis for dialogue between fisheries scientists, managers, and local communities (Brelsford 2009).

One example of converging TEK and scientific research, funding under the Fisheries Resource Monitoring Plan, is a whitefish radiotelemetry project conducted by the USFWS on the lower Kuskokwim River (Harper et al. 2008). TEK interviews conducted in several lower Kuskokwim River communities appear to confirm that whitefish migrate into the area during the spring, feed in lakes during the summer, and out-migrate in the fall. Whitefish spawn in the fall, after leaving summer feeding areas, which corresponds to locals' observations. Both locals and scientists think that juvenile whitefish rear in tundra lakes of the Kuskokwim river drainage (Ray et al. 2010). Locals also believe that whitefish do travel long distances and overwinter up river, but the scientists could not confirm this since the scientists did not collect data during the winter (Ray et al. 2010). Several tagged whitefish were caught in the Bethel area indicating that whitefish populations could be under pressure from fishers in other more populated areas (Ray et al. 2010). Thus, TEK adds information, perspective, and meaningful participation by the people most affected by resource management and development plans.

Local observations, or TEK, regarding climate change are another important source of information on current and changing subsistence practices. The Alaska Native Tribal Health Consortium (ANTHC 2015) is cataloguing such observations in a statewide Local Environmental Observer (LEO) Network database.

3.21.5 AFFECTED ENVIRONMENT

The description of subsistence harvest patterns focuses on community profiles from nine subregions. The Kuskokwim River is divided into four subregions: Upper, Central, Lower-Middle, and Lower. Other subregions are the Bering Sea Coast, Mouth of the Yukon River, Lower Yukon River, Middle Yukon River, and Cook Inlet (see Figure 3.21-1). Within each subregion, subsistence users generally share a common ecology, a common language, and some common harvest patterns. The decision to examine subsistence at the subregional and community level is to clearly demonstrate subregional patterns highlighting communities that have comprehensive subsistence harvest survey data. Resource use practices fall into the subregional patterns, and impacts from the Donlin Gold Project are likely to similarly affect communities within a subregion. As a result, a decision was made to profile selected communities in the region to describing the affected environment.

The first criterion for choosing which communities to profile was to select those whose subsistence practices may be directly affected by the Mine Site, the Transportation Corridor, and the Pipeline. In this section, the subregions are presented in a sequence with the Kuskokwim River basin subregions first, followed by the Bering Sea Coast, the mouth of the Yukon, the middle Yukon, and finally the Cook Inlet subregion. Communities located in the Kuskokwim River basin subregions and the Cook Inlet subregion may experience both environmental and sociocultural impacts from the Donlin Gold Project while those communities on the Bering Sea Coast and Yukon River communities, in contrast, may be affected primarily by the sociocultural impacts of employment at the Donlin Gold Project. For

this reason, we have more briefly summarized the subsistence practices of communities in the Bering Sea Coast and Yukon subregions.

A second criterion for choosing which communities to profile was the availability of detailed harvest data Detailed harvest data are not equally available for all potentially affected communities; the best and most recent data presented in this section are drawn from studies commissioned by Donlin Gold conducted by the Alaska Department of Fish and Game (ADF&G), Division of Subsistence. These communities and study years are:

- Study year 2009: Aniak, Chuathbaluk, Crooked Creek, Lower Kalskag, Red Devil, Sleetmute, Stony River, and Upper Kalskag (CL Brown et al. 2012).
- Study year 2010: Akiak, Georgetown, Kwethluk, Napaimute, Oscarville, and Tuluksak (Brown et al. 2013).
- Study year 2011: McGrath, Napakiak, Napaskiak, Nikolai, Takotna, Anvik, Grayling, and Russian Mission (Ikuta et al. 2014).
- Study year 2013: Scammon Bay, Quinhagak, Eek, Tuntutuliak, Pilot Station, and Shageluk (Ikuta et al. 2016).
- Study year 2012: Bethel (Runfola et al. 2017)

Additional data have been used from older ethnographies and from reports compiled by the Division of Subsistence and other divisions at ADF&G on specific species. This is the best available data on subsistence at the community level, and provides reliable documentation on an array of important subsistence resources, levels of participation in subsistence activities, harvest levels, traditional use areas, and sharing networks.

3.21.5.1 SUBSISTENCE HARVEST PATTERNS: UPPER KUSKOKWIM SUBREGION

The upper Kuskokwim subregion includes the predominantly Athabascan communities of Telida, Takotna, Medfra, McGrath, and Nikolai. Lime Village is included in the upper Kuskokwim subregion although the community is not located on the mainstem of the Kuskokwim and residents speak the Dena'ina language. Nikolai is a smaller, community, highly reliant on subsistence resources of the Upper Kuskokwim Basin and was chosen as an example for this subregion. This discussion provides a general overview of the subsistence practices of Nikolai. Section 3.21.6.3.3 analyzes the overlap and impacts to Nikolai subsistence use areas with the Pipeline.

The Upper Kuskokwim subregion includes four contemporary communities, of which McGrath is the largest. Neither Telida nor Medfra have resident populations or future resettlement and development plans. The current harvest patterns of the four contemporary communities reflect their historical dependence on a diverse resource base with heavy reliance on moose and salmon supplemented by harvests of small game, non-salmon fish species, migratory birds and eggs, and a wide variety of edible plants. Data from household surveys conducted at Lime Village in 2007 (Holen and Lemons 2010) show that residents harvested and estimated 24,991 edible pounds of subsistence resources in 2007. Subsistence harvest and use data collected in McGrath, Nikolai, and Takotna in 2012 (Ikuta et al. 2014) show that these three communities harvested an estimated total of 151,053 edible pounds of subsistence resources in 2011. No community harvest data are available for Telida or Medfra. For the three upper Kuskokwim

communities, moose was the primary species harvested, followed by Chinook salmon. In Lime Village, the bulk of the subsistence harvest was composed of sockeye salmon, caribou, and then moose. Per capita harvests for the four villages in this subregion varied from 936 pounds in Lime Village to 162 pounds in Takotna (Table 3.21-1).

Subsistence harvests in upper Kuskokwim communities involve a high reliance on large land mammals and fish. These resources are harvested at different times of the year (shown in Figure 3.21-2) illustrating the seasonal round of Nikolai as an example for the Upper Kuskokwim sub-region.

3.21.5.1.1 NIKOLAI

Nikolai is an Athabascan community located on the south fork of the Kuskokwim River, 46 air miles east of McGrath. Because of its geographic isolation and for economic and cultural reasons subsistence remains important to the community. Ikuta et al. (2014) estimated Nikolai's population was 117 people in 2011. In January of 2012, Ikuta et al. (2014), researchers from ADF&G, surveyed 26 of 39 households in Nikolai to determine subsistence harvests and use during calendar year 2011. The researchers estimated Nikolai's total harvest in 2011 was 58,416 pounds with an average household harvest of 1,498 pounds. The average per household income in 2011 was $28,638 (Ikuta et al. 2014).

Species harvested and used: Nikolai households used an average of 19 different subsistence resources in 2011 and every household reported using and harvesting at least one subsistence resource (Ikuta et al. 2014). Table 3.21-2 shows the use, harvest, and sharing rates of subsistence resources by households in Nikolai in 2011. This and corresponding tables for other communities include resources received from households in other communities, the regifting of resources, and the use of resources obtained in previous years. So in some cases, more households gave away a resource than harvested it and in some instances more households used a resource during the study year than harvested and received that resource. Large land mammals and vegetation were the two most widely used resource categories (100 percent of households), followed by birds and eggs (88 percent) and salmon (85 percent). All surveyed households used moose, while 89 percent used firewood, 81 percent used spruce grouse, and 73 percent used Chinook salmon. Over 65 percent of households surveyed said they harvested a large land mammal and 58 percent said they harvested a moose (Table 3.21-2). All households reported harvesting vegetation and 65 percent reported harvesting fish (Ikuta et al. 2014).

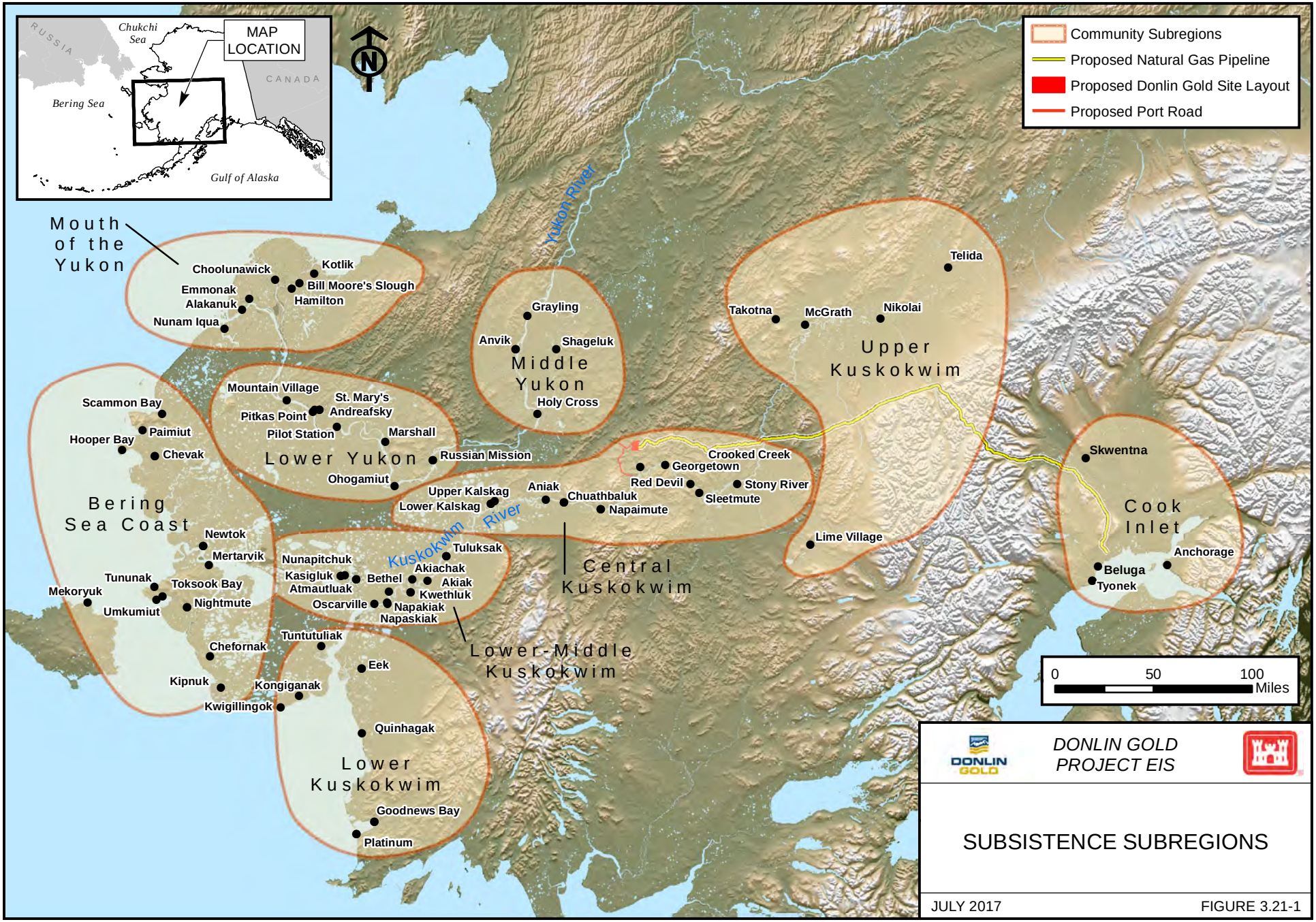

MAP LOCATION
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
N
Community Subregions
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Yukon River
Mouth of the Yukon
Choolunawick
Kotlik
Emmonak
Bill Moore's Slough
Alakanuk
Hamilton
Nunam Iqua
Grayling
Anvik
Shageluk
Middle Yukon
Holy Cross
Telida
Takotna
McGrath
Nikolai
Upper Kuskokwim
Mountain Village
St. Mary's
Scammon Bay
Pitkas Point
Andreafsky
Paimiut
Hooper Bay
Pilot Station
Marshall
Chevak
Lower Yukon
Russian Mission
Ohogamiut
Crooked Creek
Georgetown
Red Devil
Stony River
Sleetmute
Skwentna
Upper Kalskag
Aniak
Chuathbaluk
Lower Kalskag
Napaimute
Kuskokwim River
Bering Sea Coast
Newtok
Mertarvik
Tuluksak
Lime Village
Cook Inlet
Anchorage
Nunapitchuk
Akiachak
Tununak
Kasigluk
Bethel
Akiak
Toksook Bay
Atmautluak
Kwethluk
Mekoryuk
Nightmute
Oscarville
Napakiak
Umkumiut
Napaskiak
Central Kuskokwim
Beluga
Tyonek
Tuntutuliak
Chefornak
Eek
Kipnuk
Kongiganak
Kwigillingok
Lower-Middle Kuskokwim
Quinhagak
Lower Kuskokwim
Goodnews Bay
Platinum
0
50
100
Miles
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SUBREGIONS
JULY 2017
FIGURE 3.21-1

Table 3.21-1: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Upper Kuskokwim Subregion Communities

	Nikolai	McGrath	Takotna	Lime Village
Reference Year	**2011**	**2011**	**2011**	**2007**
All Resources	**499.3**	**236.45**	**161.6**	**935.5**
Marine Mammals	**0.0**	**0.0**	**0.0**	**0.0**
Large Land Mammals	**247.2**	**115.0**	**131.2**	**242.8**
Black bear	10.4	6.6	7.0	20.5
Brown bear	1.5	0.2	0.0	0.0
Caribou	1.9	1.1	0.0	158.8
Dall sheep	0.0	0.0	0.0	0.0
Moose	233.3	107.0	124.2	63.5
Small Land Mammals	**10.9**	**6.4**	**5.5**	**17.1**
Beaver	9.2	5.8	5.5	13.4
Coyote	0.0*	0.0*	0.0	0.0
Red fox	0.0	0.0*	0.0*	0.0*
Snowshoe hare	0.4	0.5	0.0	0.0
River otter	0.0*	0.0*	0.0*	0.0
Lynx	0.0*	0.0*	0.0*	0.0
Marmot	0.0	0.0	0.0	0.0
Marten	0.0*	0.0*	0.0*	0.0*
Mink	0.0	0.0*	0.0*	0.0
Muskrat	0.0	<0.1	0.0	0.0
Porcupine	1.1	0.1	0.0	3.8
Arctic ground squirrel	0.2	0.0	0.0	0.0
Weasel	0.0*	0.0*	0.0*	0.0
Wolf	0.0*	0.0*	0.0*	0.0*
Wolverine	0.0*	0.0*	0.0*	0.0*
Fishes	**207.0**	**91.6**	**9.9**	**605.7**
Salmon	131.1	66.0	1.4	555.8
Non-salmon	75.9	25.6	8.5	49.9
Marine Invertebrates	**<0.01**	**0.2**	**0.0**	**0.0**
Birds and Eggs	**24.4**	**9.1**	**10.8**	**21.6**
Sandhill crane	0.1	0.4	0.0	0.0
Ducks	8.2	1.4	0.4	12.1
Geese	10.1	2.1	0.5	5.4
Swans	0.4	0.1	0.0	0.7

Table 3.21-1: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Upper Kuskokwim Subregion Communities

	Nikolai	McGrath	Takotna	Lime Village
Reference Year	**2011**	**2011**	**2011**	**2007**
Grouse and ptarmigan	5.6	5.1	9.9	3.4
Bird eggs	0.0	0.0	0.0	0.0
Vegetation	**9.8**	**14.2**	**4.3**	**48.2**

Notes:
Populations used in per capita harvest calculations – Nikolai: 117.0; McGrath: 356.3; Takotna: 51.9; Lime Village: 26.7
* Small mammal species that were harvested, but are not typically eaten. Harvest weight was not calculated for species harvested but not eaten.

Source: Holen and Lemons 2010; Ikuta et al. 2014

By edible weight, moose made up the bulk of the total community harvest in 2011 (47 percent), followed by Chinook salmon (18 percent), northern pike (5 percent), coho salmon (4 percent), and sheefish (4 percent) (Figure 3.21-3). Chum salmon, humpback whitefish, black bear, beaver, and Bering cisco rounded out the top ten species by edible weight. Fishes formed a large portion (41 percent) of the 2011 subsistence harvest by edible weight. All five species of Pacific salmon were harvested by Nikolai residents, although Chinook salmon dominated the harvest (45 percent of total fish harvest by edible weight).

Harvest areas: In 2011, surveyed households used a 757-square-mile area for subsistence activities. Nikolai residents reported that harvest areas for most subsistence resources overlapped their traditional territory and included a very large area encompassing most of the major tributaries of the Upper Kuskokwim drainage (Figure 3.21-4).

In 2011, households reported searching for moose primarily around the village, along the South Fork of the Kuskokwim River downstream from Nikolai, the Salmon River, and the North Fork of the Kuskokwim almost to Telida. Caribou, moose, as well as black and brown bear were also hunted along the South Fork of the Kuskokwim River and the upper reaches of Windy Fork of the Kuskokwim into the foothills of the Alaska Range (Ikuta et al. 2014).

Most Nikolai residents fished for Chinook salmon along the Salmon River, Pitka's Fork near Medfra, the North Fork of the Kuskokwim, and Blackwater Creek. Whitefish harvest locations are almost limitless in the area around Nikolai and residents spoke of harvesting whitefish in numerous locations almost year around. Northern pike is another important resource that was widely available throughout the area (Ikuta et al. 2014).

Sharing: Harvesting households share wild foods widely, through kinship and friendship relationships, between households within Nikolai and with households in other communities in Alaska (Figure 3.21-5). Each node represents one household (or household in another community in the case of the blue circle), the size of which corresponds to the household's total harvest amount. The nodes are shaped according to the structure of the household, and colored according to age of the heads of household. The directional arrows portray sharing of resources and originate from the source household. The weight of the line represents the number of links between households.

Figure 3.21-2: Nikolai Seasonal Round of Subsistence Harvests

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Black bear				--				--	--	--	--	--				--								
Grizzly bear					--		--									--								
Moose								--	--	--	--													
Caribou	--													--	--	--	--	--						
Sheep	--	--												--	--							--	--	
Wolf												--	--	--	--	--	--	--	--					
Marten																								
Mink																								
Otter																								
Fox																								
Lynx																								
Beaver								--	--	--	--	--	--	--	--					--	--			
Muskrat				--				--																
Hare							--						--											
Porcupine					--																			
Waterfowl			--				--	--			--	--	--											
Grouse							--				--							--	--	--	--			
Berries								--	--	--						--								
Plants							--	--	--			--	--											
Firewood																								
Chinook salmon							--				--	--												
Chum salmon									--					--	--	--	--	--						

Figure 3.21-2: Nikolai Seasonal Round of Subsistence Harvests

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Coho salmon											--	--	--											
Whitefish								--	--	--	--	--	--				--							
Sheefish					--	--				--				--	--	--	--	--						
Pike	--			--	--		--	--	--	--	--	--	--			--	--	--						--
Blackfish	--	--																					--	--
Grayling								--	--	--	--	--	--	--										

Notes:
Shaded cells denote concentrated use
-- denotes intermittent use

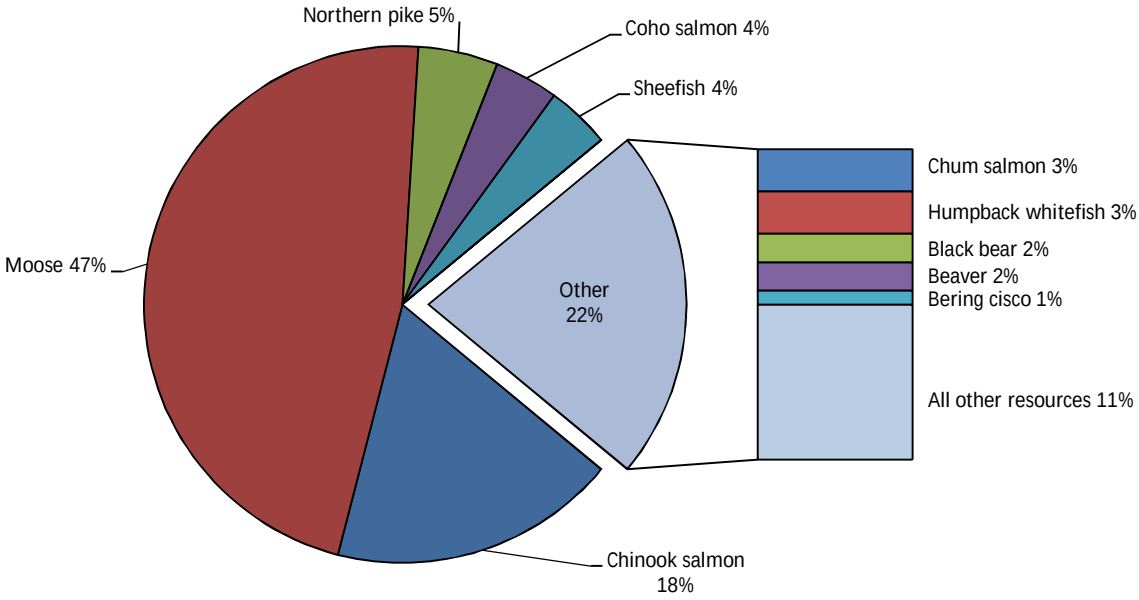
Source: Stokes 1985

Table 3.21-2: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Nikolai, 2011

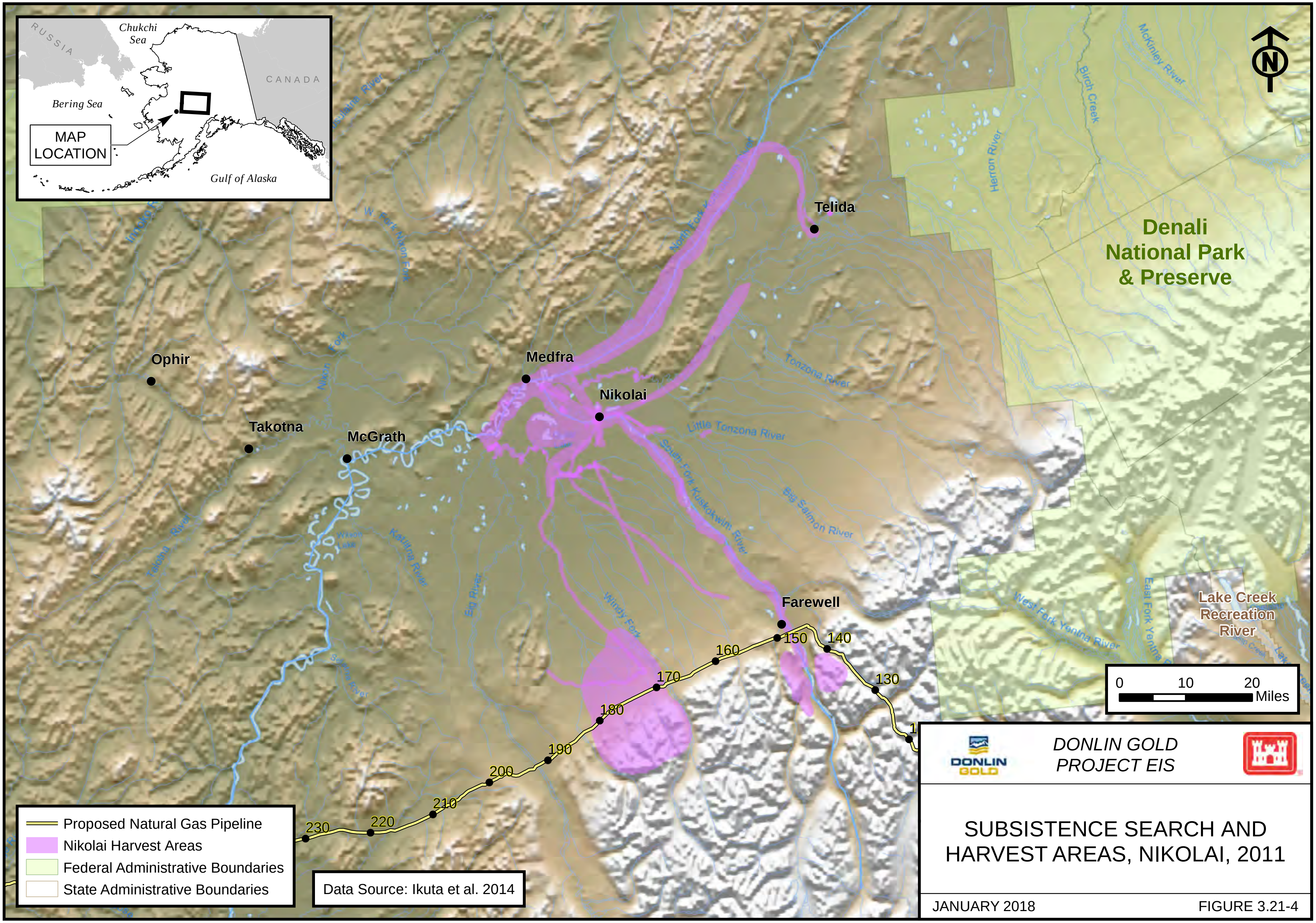
	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Salmon	**84.6**	**46.2**	**50.0**	**73.1**
Chinook	73.1	42.3	34.6	57.7
Chum	46.2	11.5	7.7	42.3
Coho	50.0	23.1	15.4	34.6
Sockeye	19.2	15.4	7.7	11.5
Pink	7.7	3.8	0.0	3.8
Unknown salmon	3.8	0.0	3.8	3.8
Non-Salmon Fishes				
Humpback whitefish	38.5	26.9	11.5	15.4
Sheefish	50.0	34.6	19.2	23.1
Northern pike	69.2	57.7	34.6	26.9
Mammals				
Black bear	50.0	26.9	19.2	38.5
Caribou	15.4	3.8	7.7	15.4
Moose	100.0	57.7	57.7	65.4
Beaver	53.8	42.3	23.1	34.6
Snowshoe hare	19.2	19.2	0.0	0.0
Muskrat	0.0	0.0	0.0	0.0
Seal	3.8	0.0	0.0	3.8
Marine Invertebrates	**7.7**	**3.8**	**0.0**	**3.8**
Birds and Eggs	**88.5**	**88.5**	**42.3**	**42.3**
Ducks	53.8	42.3	23.1	23.1
Geese	64.5	46.2	26.9	26.9
Grouse and ptarmigan	80.8	80.8	34.6	23.1
Bird eggs	0.0	0.0	0.0	0.0
Vegetation	**100.0**	**100.0**	**57.7**	**73.1**
Berries	80.8	76.9	46.2	57.7
Wood	88.5	76.9	34.6	42.3

Notes:
Data based on surveys of 26 of 39 households in Nikolai
Source: Ikuta et al. 2014

Figure 3.21-3: Composition of Nikolai Subsistence Harvest by Estimated Edible Weight, 2011



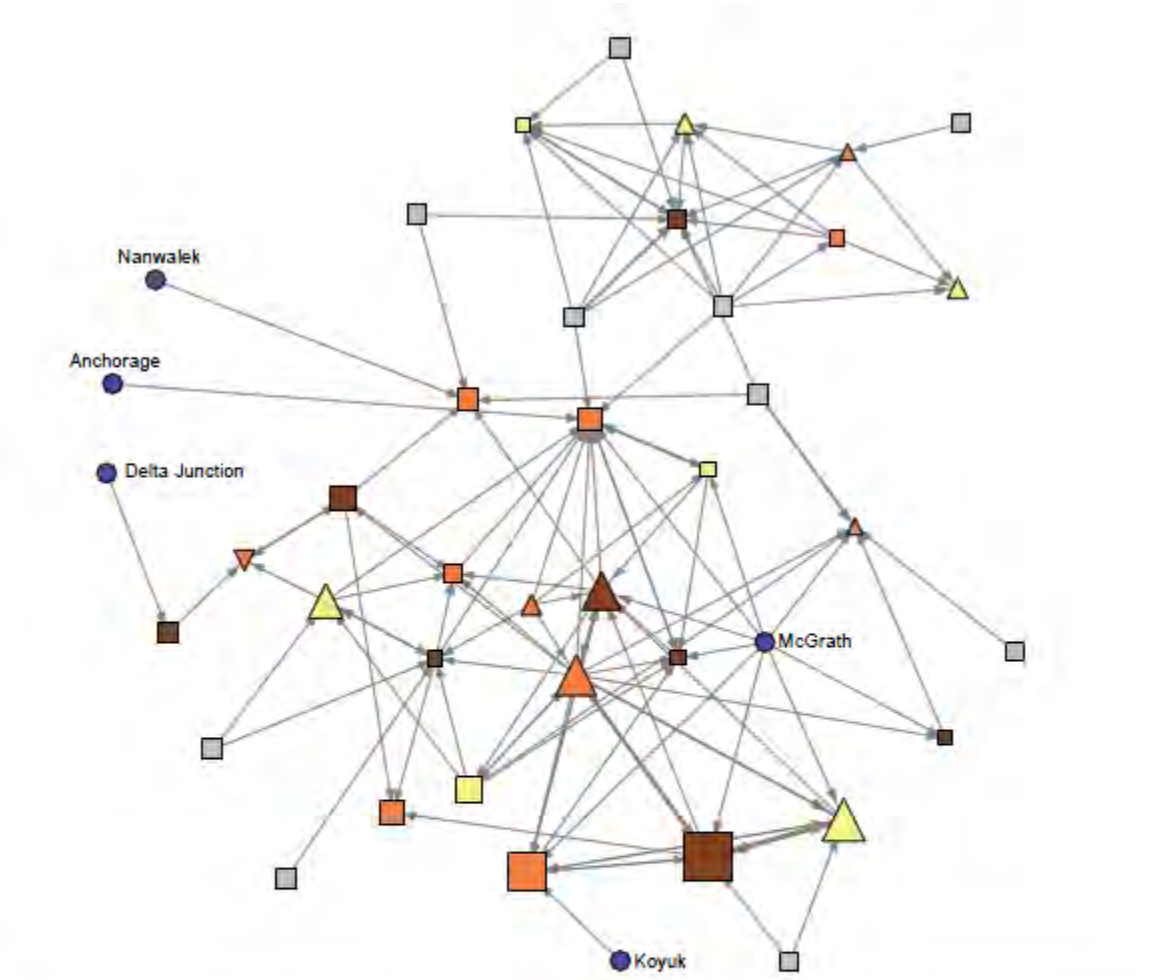
Source: Ikuta et al. 2014



SUBSISTENCE SEARCH AND HARVEST AREAS, NIKOLAI, 2011

JANUARY 2018

FIGURE 3.21-4



LEGEND

	Age of household head (years)			
	< 40	40 to 59	> 59	Unknown
Couple head	△	△	△	△
Single female head	▽	▽	▽	▽
Single male head	△	△	△	△

SYMBOLS are scaled by households' total subsistence harvests (in edible pounds). Surveyed households with many sources of goods and services appear near the center of the figure. Households with fewer sources appear around the edges.

Flows of wild foods from source harvesting and processing households to consuming households, as reported by consuming (surveyed) households

Household not surveyed

Household in another community

LINES are scaled by the number of resources harvested and processed by other households for surveyed households. Arrows point from source households to surveyed households. A household's production for itself is not shown.

Data Source: Ikuta et al. 2014

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WILD FOOD HARVESTING AND PROCESSING NETWORK, NIKOLAI, 2011

JULY 2017 FIGURE 3.21-5

In many Alaska Native communities, approximately 30 percent of households produce 70 percent of the subsistence harvest. A part of this harvest is shared with other members of the community. High harvesting households can take several configurations. Most are headed by a mature married couple with grown children, but some are headed by a single male or, in the case of Nikolai, headed by a single female. Another characteristic of these households is that they frequently have high incomes and access to the necessary equipment such as boats, motors, and firearms. Where data are available, we have included information about income levels or employment for individual high harvesting households.

In Nikolai, the composition of high harvesting households, depicted by the larger triangles and squares in Figure 3.21-5, varied and included households headed by single males and single females as well as married couples, suggesting that harvesting and sharing patterns are transferred between generations (Ikuta et al. 2014). Almost all (92 percent) households said that they had received subsistence resources, and 85 percent said they had given away a resource. Moose, berries, and Chinook salmon were each received by over half of surveyed households (Table 3.21-2). Residents also reported sharing food with households in five other communities, particularly McGrath (Ikuta et al. 2014).

Variability: In 2011, Nikolai residents described long-term changes in subsistence over the past century. These changes included reduction in the amount of salmon harvested for dog food, an increase in the reliance on moose corresponding with the increase in moose populations at the start of the 20th century, and regulatory restrictions that affected the harvest patterns of Chinook salmon, caribou, and Dall sheep. Changes that are more recent include observed declines in the size and abundance of Chinook salmon, increases in the price of gasoline that has limited travel for subsistence, and the decline in locally available caribou herds (Ikuta et al. 2014).

3.21.5.2 SUBSISTENCE HARVEST PATTERNS: CENTRAL KUSKOKWIM SUBREGION

The Central Kuskokwim subregion includes the ten communities of Stony River, Sleetmute, Red Devil, Georgetown, Crooked Creek, Napaimute, Chuathbaluk, Aniak, Upper Kalskag, and Lower Kalskag. In the study year of 2010, Georgetown and Napaimute had no year-round resident population (Brown et al. 2013). Brown et al. (2013) surveyed Georgetown and Napaimute in 2011 (study year 2010) and CL Brown et al. (2012) surveyed the other eight central Kuskokwim communities in 2010 (study year 2009). The estimated total population of the eight residential communities in 2009 was 1,450. The populations of Red Devil, Sleetmute, and Stony River were small and declining as residents move to find better employment opportunities, while the other five communities experienced slight population increases (CL Brown et al. 2012).

The contemporary harvest patterns are documented for eight of the communities and largely reflect historical patterns typified by a diverse resource base with heavy reliance on salmon and moose supplemented by harvests of small game, non-salmon fish species, migratory birds and eggs, and a wide variety of edible plants. In 2009, residents of the eight documented communities harvested an estimated total of 411,135 edible pounds of subsistence resources, or an average of 291.8 pounds per person. Chinook, chum, coho, and sockeye salmon provided 65 percent of the total regional subsistence harvest by weight and moose contributed 11 percent (despite the closure of the local GMU 19A to moose hunting). By itself, Chinook salmon provided 30 percent of the regional harvest (CL Brown et al. 2012). Per capita harvests for these

Central Kuskokwim communities varied from 186.7 pounds in Lower Kalskag to 532.5 pounds in Stony River (Table 3.21-3).

In order to provide an overview of the subsistence practices of the Central Kuskokwim River subregion, the communities of Stony River, Sleetmute, Crooked Creek, Chuathbaluk, and Aniak, were selected as examples. Each has the potential to be affected by the Donlin Gold Project and recent data are available. Due to the intense interest of the communities in this subregion near the Donlin Gold Project, a larger set of example communities is profiled.

3.21.5.2.1 STONY RIVER

Stony River is located on the north bank of the Kuskokwim River, 2 miles north of its junction with the Stony River. The village is 100 miles east of Aniak, 185 miles northeast of Bethel, and 225 miles west of Anchorage. One of the smallest villages in the subregion, Stony River had a population of 42 in 2010. In March 2010, researchers from ADF&G surveyed 12 of 20 households in Stony River. Questions on the survey pertained to harvests obtained in 2009. Expanding for the eight unsurveyed households, Stony River's estimated total harvest in 2009 was approximately 33,726 pounds with an average per household harvest of 1,686 pounds. The average household income was $19,695 (CL Brown et al. 2012).

Species Harvested and Used: Every household in Stony River reported using at least one wild resource in 2009 and 83 percent reported that a household member had harvested wild foods. Fish was the most widely used resource (100 percent). Ninety-two percent of households said they used land mammals and some form of edible plant, and 75 percent said they used birds and eggs. In terms of harvesting wild foods, 58 percent of households said they harvested fish, 50 percent harvested land mammals, 83 percent harvested vegetation, and 67 percent said they harvested birds (CL Brown et al. 2012). No one reported a harvest of eggs (Table 3.21-4).

Four species of salmon contributed 68 percent of the total community harvest. Chinook salmon contributed more than any other single species (Figure 3.21-6). In terms of edible pounds, fish were the largest category of wild resource harvested in terms of edible pounds (86 percent of the total community harvest), followed by land mammals, edible plants, and birds (CL Brown et al. 2012).

Table 3.21-3: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Eight Central Kuskokwim Subregion Communities, 2009

	Stony River	Sleetmute	Red Devil	Crooked Creek	Chuathbaluk	Aniak	Upper Kalskag	Lower Kalskag
All Resources	**532.5**	**405.2**	**305.3**	**245.4**	**244.1**	**306.3**	**345.1**	**186.7**
Marine Mammals	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.1**	**0.0**	**0.0**
Seals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Walrus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Whale	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
Large Land Mammals	**20.3**	**43.9**	**21.3**	**25.5**	**40.9**	**43.0**	**46.4**	**35.3**
Black bear	2.6	6.0	16.3	8.4	3.9	2.5	5.6	0.4
Brown bear	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.1
Caribou	3.4	3.3	5.0	0.0	3.8	1.0	0.8	1.6
Dall sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moose	14.2	34.6	0.0	17.1	31.8	39.4	40.0	32.3
Small Land Mammals	**38.7**	**15.1**	**8.8**	**6.8**	**8.0**	**3.3**	**7.9**	**3.3**
Beaver	38.7	13.3	7.8	6.3	7.2	2.9	4.0	2.7
Hare	0.0	1.5	0.4	0.3	0.2	0.2	2.0	0.3
River otter	0.0	0.2	0.1	0.0	0.3	0.0	0.9	0.0
Lynx	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
Marmot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mink	0.0	0.0	0.1	0.0	0.0	0.0	0.6	0.0
Muskrat	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1
Porcupine	0.0	0.1	0.1	0.1	0.2	0.0	0.3	0.1
Squirrel	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0
Fishes	**458.4**	**330.1**	**261.6**	**200.2**	**179.0**	**249.9**	**247.1**	**130.8**
Salmon	366.0	277.1	141.7	171.1	159.0	198.2	198.8	98.6

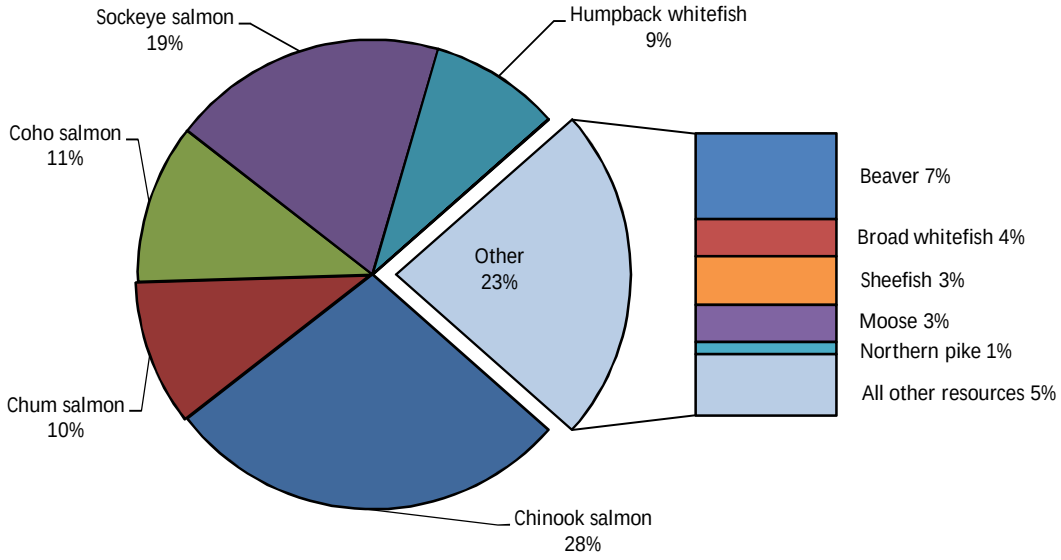
Table 3.21-3: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Eight Central Kuskokwim Subregion Communities, 2009

	Stony River	Sleetmute	Red Devil	Crooked Creek	Chuathbaluk	Aniak	Upper Kalskag	Lower Kalskag
Non-salmon	92.4	53.0	119.9	29.2	20.0	51.7	48.3	32.2
Marine Invertebrates	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**
Birds and Eggs	**5.3**	**5.6**	**5.7**	**01.8**	**2.5**	**2.1**	**7.5**	**4.6**
Sandhill crane	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3
Ducks	0.9	1.6	0.6	0.6	0.8	0.6	1.1	1.1
Geese	0.3	1.0	0.3	0.2	0.8	0.4	3.2	1.4
Swans	0.0	0.5	0.0	0.1	0.0	0.0	0.5	0.8
Grouse and ptarmigan	4.2	2.5	4.8	0.9	0.9	1.0	1.9	1.0
Bird eggs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetation	**9.8**	**10.5**	**8.0**	**10.9**	**13.7**	**6.0**	**36.2**	**12.7**

Notes:
Estimated community populations for 2009 – Stony River: 63; Sleetmute: 90; Red Devil: 32; Crooked Creek: 139; Chuathbaluk: 122; Aniak: 502; Upper Kalskag: 203; Lower Kalskag: 299
Firewood and small land mammal species that are trapped but not typically eaten are excluded from table

Source: CL Brown et al. 2012

Figure 3.21-6: Composition of Stony River Subsistence Harvest by Estimated Edible Weight, 2009



Source: CL Brown et al. 2012

Table 3.21-4: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Stony River, 2009

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Salmon	**100**	**58**	**33**	**67**
Chinook	58	50	33	25
Chum	58	42	25	17
Coho	67	50	25	25
Sockeye	58	50	33	17
Pink	25	25	17	0
Unknown salmon	33	0	0	33
Non-Salmon				
Humpback whitefish	50	33	17	33
Sheefish	58	42	17	25
Broad whitefish	50	33	17	33
Mammals	**92**	**50**	**50**	**58**
Black bear	8	8	8	0
Caribou	42	8	0	33
Moose	50	8	25	42
Beaver	42	33	42	8
Hares	0	0	0	0
Muskrat	0	0	0	0
Seals	0	0	0	0
Birds and Eggs	**75**	**67**	**33**	**17**

Table 3.21-4: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Stony River, 2009

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Ducks	50	42	25	17
Geese	25	17	8	8
Upland birds	75	67	17	17
Bird eggs	0	0	0	0
Vegetation	**92**	**83**	**25**	**33**
Berries	83	75	8	33
Plants/greens/mushrooms	58	58	17	17
Wood	83	83	17	17

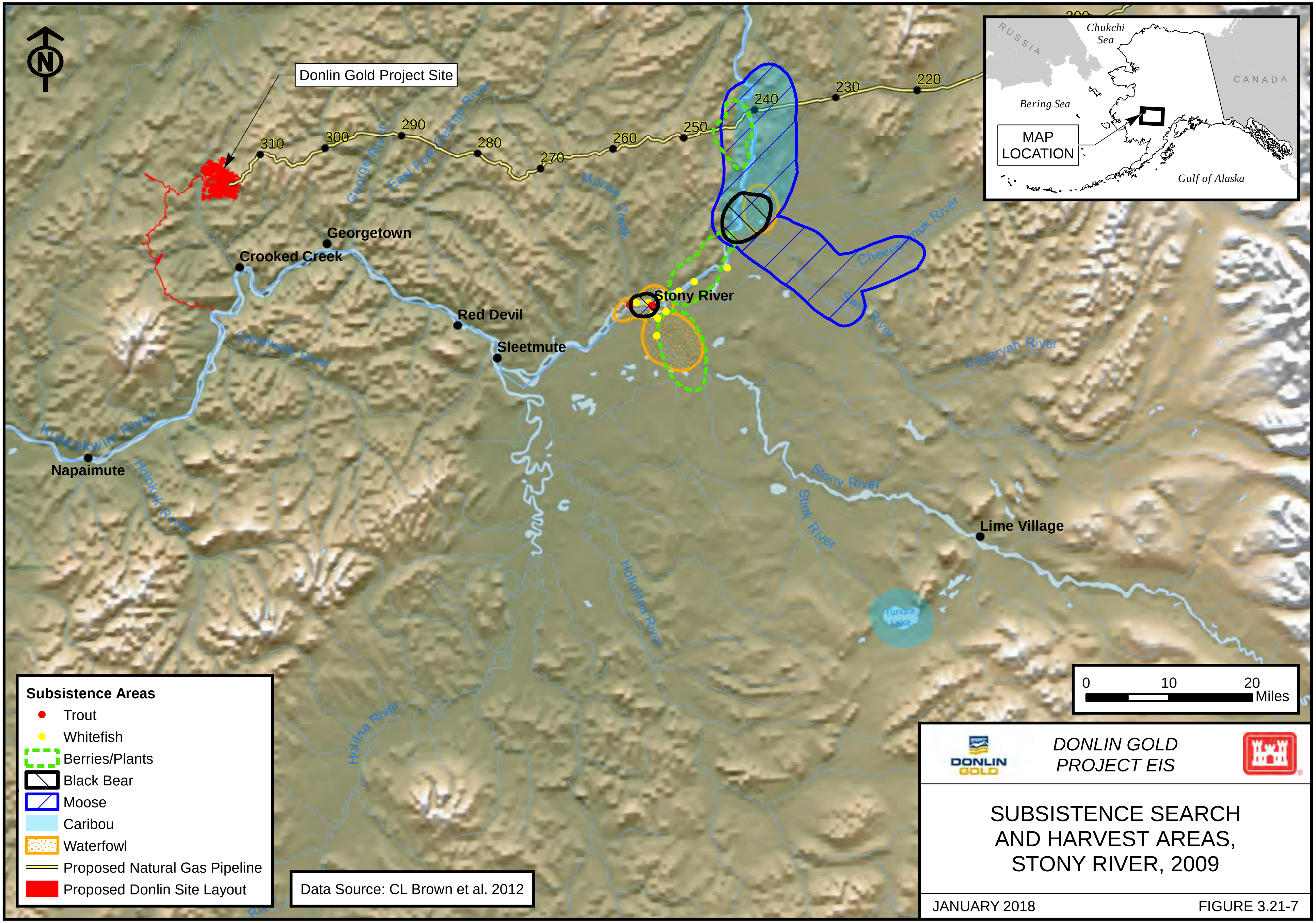
Notes:
Data based on surveys of 12 of 20 households in Stony River
Source: CL Brown et al. 2012

Harvest Areas: In 2009, residents of Stony River reported using an area of 487 square miles. Moose were hunted on the eastern border of GMU19A and western portion of 19D covering a small area just down river from the community of Stony River and portions of the Swift River, Tatlawiksuk River, and Kuskokwim River (Figure 3.21-7). Hunters tried to harvest moose close to the river so as not to have to pack the carcass too far. Small land mammals, particularly beaver and marten were harvested north of Stony River and upriver from the village. Since trapping in no longer as profitable as it once was, trapping areas have shrunk (CL Brown et al. 2012).

Salmon harvests were concentrated along the main stem of the Kuskokwim River with some families traveling up the Stony River to fish (Figure 3.21-8). Some residents reported fishing for non-salmon fish species down river from Stony River village, particularly near the junction of the Kuskokwim and Stony rivers. Most fish were caught in gillnets, however, residents also used rod and reel and jigging gear (CL Brown et al. 2012).

Sharing: There was no discussion on wild food networks because of confidentiality issues. Ninety-two percent of households reported they received resources, while 67 percent gave away resources (CL Brown et al. 2012).

Variability: Stony River residents reported that for all resource categories, except land mammals and vegetation, they “got enough” during 2009 (CL Brown et al. 2012). Poor weather seems to have been the main factor influencing people’s harvest of vegetation.

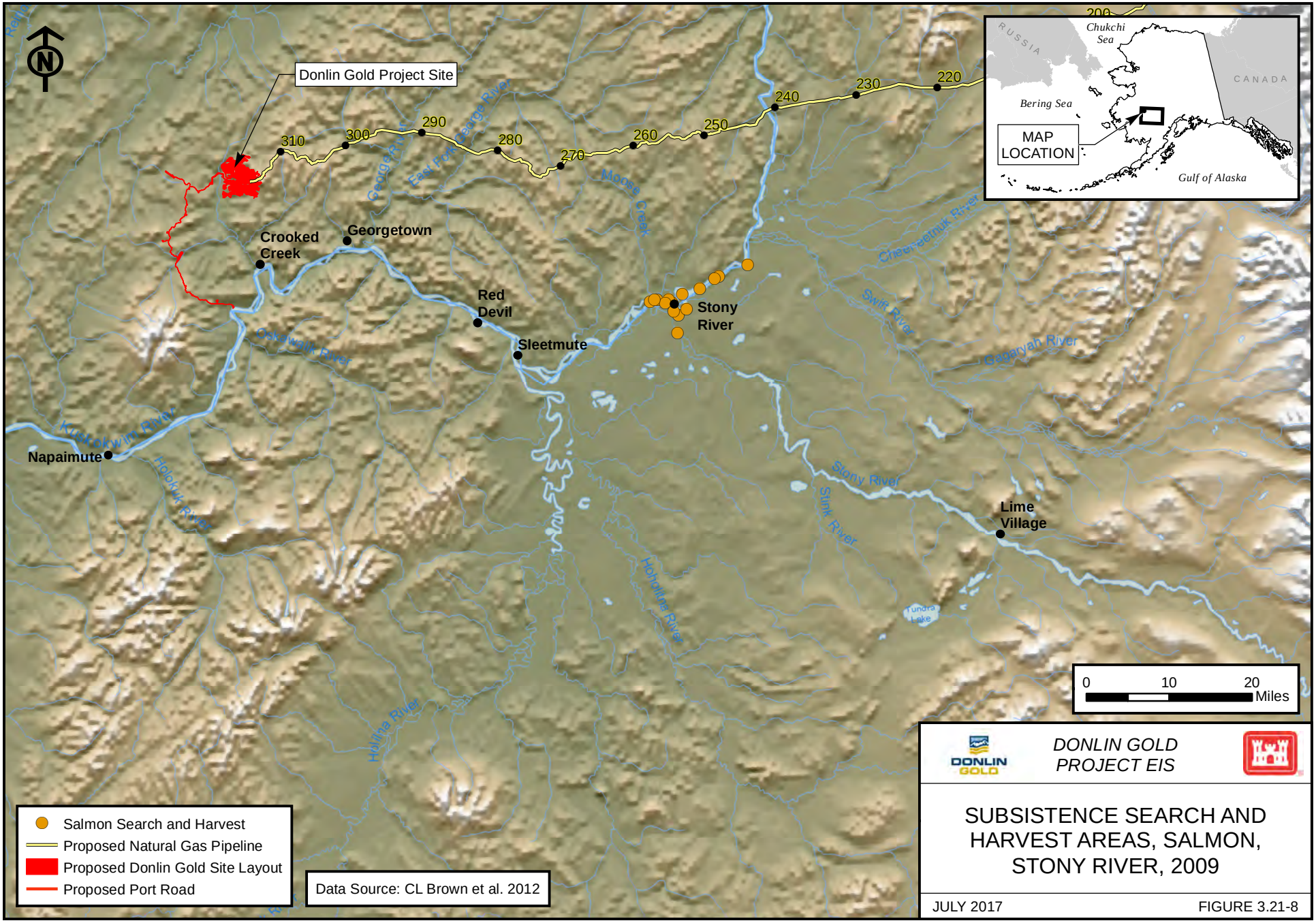


DONLIN GOLD PROJECT EIS

SUBSISTENCE SEARCH AND HARVEST AREAS, STONY RIVER, 2009

JANUARY 2018

FIGURE 3.21-7


Donlin Gold Project Site
310
300
290
280
270
260
250
240
230
220
200
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Napaimute
Lime Village
George River
East Fork George River
Moose Creek
Cheerfeetnuk River
Swift River
Gagaryah River
Oskawalik River
Kuskokwim River
Holokuk River
Stony River
Stink River
Hoholitna River
Holitna River
Tundra Lake
RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
0
10
20
Miles
Salmon Search and Harvest
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Data Source: CL Brown et al. 2012
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, SALMON, STONY RIVER, 2009
JULY 2017
FIGURE 3.21-8

The reason people said they did not get enough land mammals was resource availability. Moose hunting in 2009 was limited by extremely low water levels that restricted access, warm weather that slowed moose movements, a generally low moose population in GMU19A, and the continued closure in a large part of that GMU (CL Brown et al. 2012). In general, there has been a decline in moose and caribou harvests by Stony River residents since 2003, when ADF&G began collecting data. In 2005, 67 percent of households reported harvesting moose but in 2009, only 25 percent reported a harvest while 67 percent reported attempting to harvest (CL Brown et al. 2012). Data on Stony River salmon harvests collected between 2000 and 2009 show fluctuation in harvests for all species but an overall increase.

3.21.5.2.2 SLEETMUTE

Sleetmute is located on the east bank of the Kuskokwim River, 1.5 miles north of its junction with the Holitna River. It lies 79 miles east of Aniak, 166 miles northeast of Bethel, and 243 miles west of Anchorage. Sleetmute was originally settled by Athabascan Indians, most likely Deg Hit'an or Dena'ina, with interior Yup'ik people moving into this part of the river in the late 19th and early 20th century (Oswalt 1980a; CL Brown et al. 2012). Inter-marriages between Yup'ik and Athabascan speakers occurred in the early to mid-20th century, and children typically grew up speaking the Yup'ik language of their mothers. CL Brown et al. (2012) estimated that the population of Sleetmute was 90 people in 2009.

In 2010, 32 of 37 households participated in the household survey covering the harvest activities of the year 2009 (CL Brown et al. 2012). Expanding for the five unsurveyed households, Sleetmute's estimated total harvest in 2009 was approximately 36,547 pounds with an average per household harvest of 988 pounds. The average household income was $35,690 (CL Brown et al. 2012).

The current data set collected by the Division of Subsistence (CL Brown et al. 2012) did not include a seasonal round, so Figure 3.21-9 represents data collected in 1982-83. It shows that people fish for non-salmon fish species year-round.

Species Harvested and Used: One hundred percent of households used some kind of wild food, and 100 percent of households said that a member of that household had harvested wild food. Important subsistence resources included salmon (used by 97 percent of households); whitefishes (84 percent); and large land mammals (63 percent), including moose (56 percent) (CL Brown et al. 2012). Seventy-five percent of households said they harvested sockeye salmon, 63 percent reported a harvest of sheefish, while only 16 reported a harvesting moose (Table 3.21-5). The harvest and use of moose was reported to have much more prevalent in the past and several residents reported that prior to moose hunting closure in GMU 19A, moose were the primary subsistence resource in the village (CL Brown et al. 2012).

Figure 3.21-9: Sleetmute and Chuathbaluk Seasonal Round of Subsistence Harvests, 1982-83

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Moose	--	--	--	--	--	--	--	--	--	--	--	--			--	--	--	--	--	--	--	--		--
Caribou	--	--	--	--	--	--	--	--	--	--	--				--									
Bears						--	--	--	--	--	--													
Porcupine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Snowshoe Hare																								
Grouse																								
Ptarmigan																								
Waterfowl							--	--	--	--														
Mink																								
Marten																								
Wolf																								
Wolverine																								
River otter																								
Red fox																								
Lynx																								
Beaver																								
Muskrat																								
Salmon																								
Lamprey																								
Sheefish																								
Least cisco	--	--	--	--	--	--	--	--	--	--	--	--					--	--	--	--	--	--	--	--
Whitefishes	--																	--	--	--	--	--	--	--

Figure 3.21-9: Sleetmute and Chuathbaluk Seasonal Round of Subsistence Harvests, 1982-83

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Rainbow trout	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Arctic char	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Grayling	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Smelt						■	■																	
Blackfish															--	--	--	--	--	--				
Pike	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Sucker										■	■	■	■											
Burbot	■	■																			■	■	■	■
Greens						■	■	■	■	■	■	■	■	■										
Berries									■	■	■	■	■	■										

Notes:
Shaded cells denote concentrated use
-- denotes intermittent use

Source: Charnley 1984

Table 3.21-5: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Sleetmute, 2009

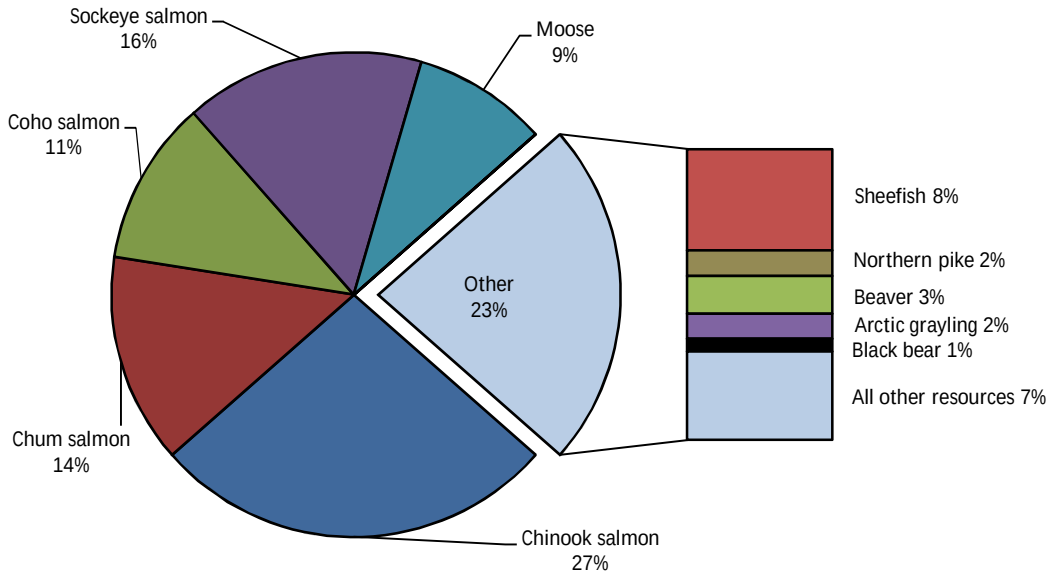
	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Salmon				
Chinook	88	69	41	38
Chum	69	53	22	25
Coho	72	63	25	25
Sockeye	91	75	47	41
Pink	9	6	3	6
Unknown salmon	0	0	0	0
Non-Salmon Fishes				
Sheefish	78	63	34	34
Smelt	3	0	0	3
Mammals				
Black bear	38	19	16	19
Caribou	3	3	3	3
Moose	56	16	19	50
Beaver	44	38	25	13
Hares	22	19	3	3
Muskrat	3	3	0	0
Seals	0	0	0	0
Birds and Eggs				
Ducks	41	31	6	16
Geese	22	19	0	3
Upland birds	69	63	13	22
Eggs	0	0	0	0
Vegetation				
Berries	75	69	22	28
Plants/greens/mushrooms	56	50	16	22
Wood	66	63	6	25

Notes:
Data based on surveys of 32 of 37 households in Sleetmute
Source: CL Brown et al. 2012.

Four species of salmon accounted for an estimated 68 percent of the total harvest while moose accounted for an additional 9 percent. Other resources, including sheefish, northern pike, beaver, Arctic grayling, and black bear made up 23 percent of the total edible harvest (CL Brown et al. 2012) (

Figure 3.21-10). Notable is the harvest and use of beaver (used by 44 percent of households) and black bears (used by 38 percent of households). Residents reported that beaver were harvested primarily for their meat rather than their pelts. An assortment of edible plants was harvested in 2009 including blueberries, high bush cranberries, currants, wild rhubarb, rose hips, and Hudson's Bay tea (CL Brown et al. 2012).

Figure 3.21-10: Composition of Sleetmute Subsistence Harvest by Estimated Edible Weight, 2009



Source: CL Brown et al. 2012

Subsistence salmon fishing is a critical part of the livelihood of Sleetmute residents: "we really work at it, that's all our life in the summertime, salmon" (CL Brown et al. 2012). Most effort was directed at the harvest of Chinook and sockeye salmon, with coho, and chum salmon pursued less intently. People said they preferred Chinook salmon to coho, because the latter did not preserve well. Residents reported that chum salmon harvests had declined because people relied less on dog teams (CL Brown et al. 2012). Most fish (87 percent) were harvested by gillnet while 12 percent were harvested with rod and reel. Sleetmute residents used both drift gillnets and setnets, shifting their nets in response to water levels and river flow.

Large land mammals comprised only 11 percent of the total harvest in the 2009 study year, while small land mammals made up 4 percent. Black bear was the most frequently harvested large land mammal (19 percent of households, but used by 38 percent), with residents harvesting an estimated five animals in 2009. Black bear are usually harvested in the spring. Some residents pointed out that the decline in moose had prompted their harvest of black bear, but not all residents were interested in harvesting black bear. Brown bears, on the other hand, are less commonly harvested today, as one resident explained.

> There's something wrong with them brown bears in our religion, in our belief, in our tradition, we never eat them. Only if you are starving and when you cook it you have to put holy water so it is blessed so you can eat it (quoted in CL Brown et al. 2012).

The community harvested six moose in 2009 (CL Brown et al. 2012). Some 34 percent of households reported attempting to harvest moose and 16 percent were successful. Most success was reported in September although moose harvests also occurred in June and July. Areas most accessible to Sleetmute hunters for moose hunting in GMU 19A were closed to hunting in 2006. For this reason, reported 2009 harvests reflect the efforts of hunters operating under a moratorium and do not reflect a normal level of community reliance on moose (CL Brown et al. 2012).

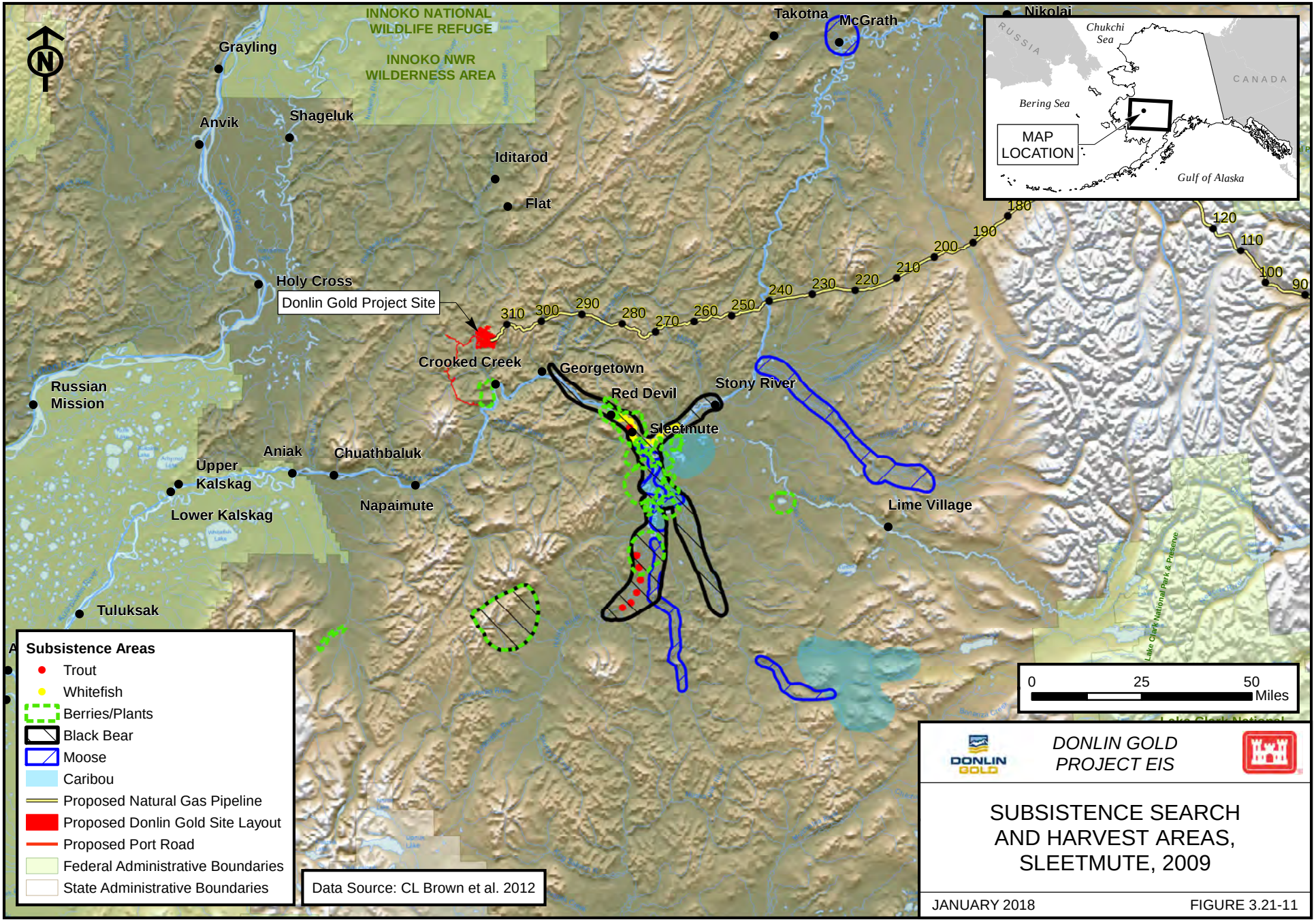
Harvest Areas: In 2009, Sleetmute residents reported using a total of 1,712 square miles for subsistence. A majority of resources were harvested within a 20-mile radius of the community but residents also reported traveling 100 miles or more in search of wild food.

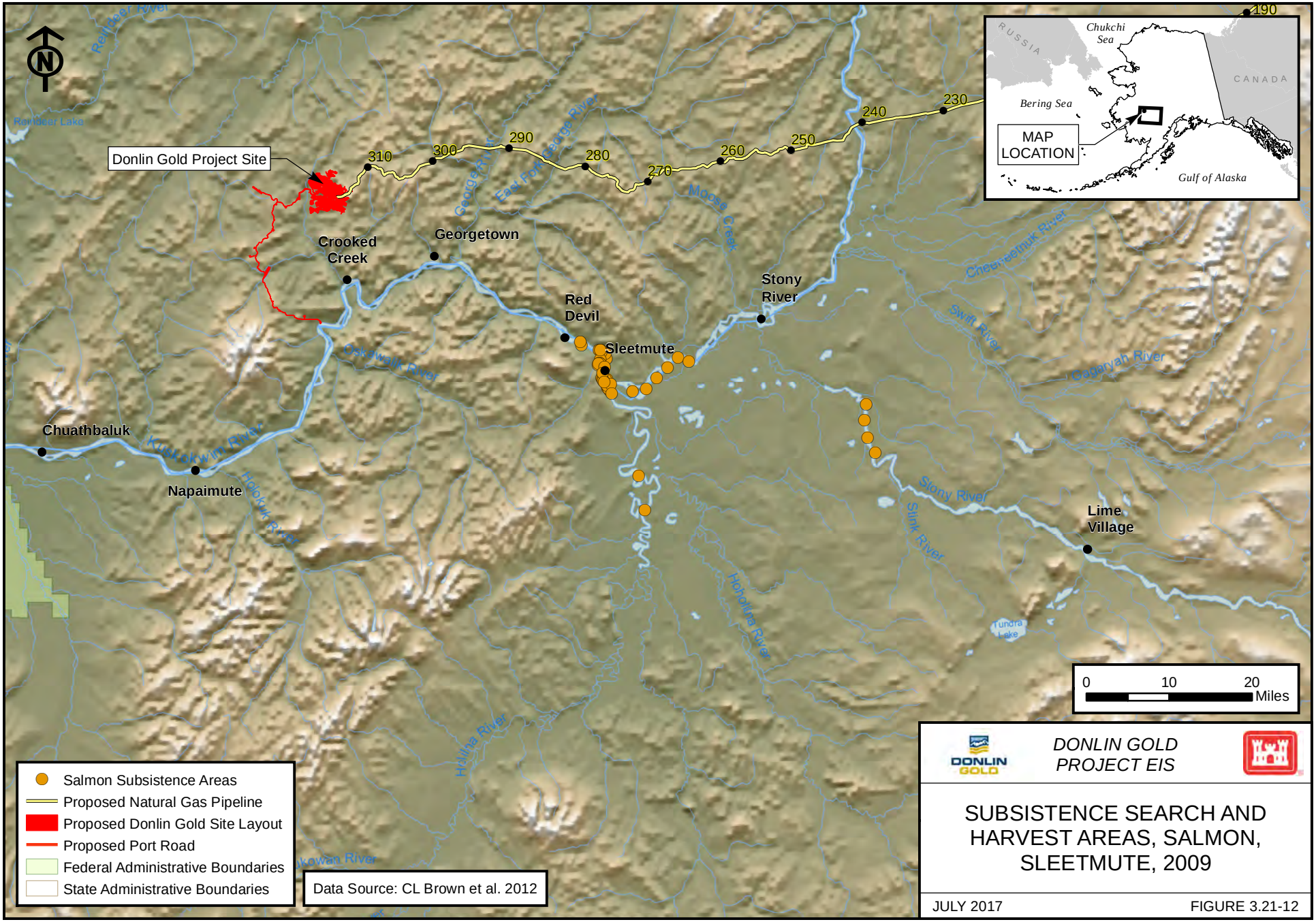
Hunting areas for moose, black bear, and caribou overlapped. This area included the Kuskokwim River corridor and various tributaries such as the Holitna, Hoholitna, and Swift river corridors, the drainage of Titnuk Creek, and the Door Mountains near the upper reaches of the Hoholitna River (Figure 3.21-11). As noted above, most of this area has been closed to moose hunting since 2006. However, the use area data do not necessarily represent illegal moose harvests, since hunters may have been hunting for other species, or they may have been hunting for ceremonial purposes (CL Brown et al. 2012).

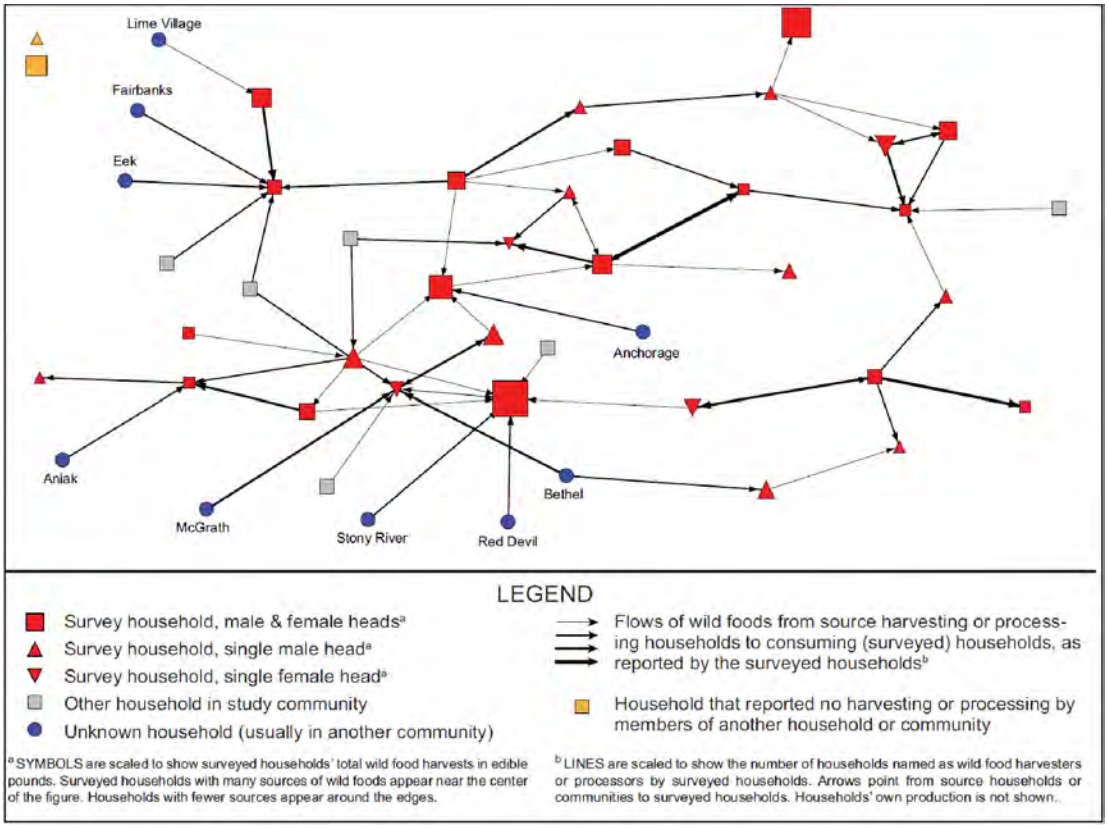
Fishing for salmon and non-salmon fish species was largely conducted close to the community (Figure 3.21-12). Quality driftnet and setnet fishing sites were found in the immediate vicinity of the town so there was no need to travel far to obtain salmon, sheefish, or whitefishes (CL Brown et al. 2012). Driftnets and setnets were used downriver from the village while setnets were used at the mouth of the Holitna River, slightly upriver from the village. Salmon were harvested primarily with nets, while rod and reel was used, for the most part, to harvest non-salmon fish species. Residents also reported fishing up the Holitna and Stony rivers.

Sharing: Sharing and the exchange of subsistence foods among community members and neighboring villages is an important practice among Middle Kuskokwim communities (Jonrowe 1980; Stickney 1981; Charnley 1984). Both fish and moose meat were reported to be widely shared among residents of Sleetmute. Residents said that sharing wild foods was particularly important and there is a tradition of giving the first Chinook salmon harvest of the season to an elder (CL Brown et al. 2012).

In Sleetmute, an estimated 31 percent of the households harvested 70 percent of the wild foods, suggesting there was a core of specialized harvesting households. In Figure 3.21-13, these high harvesting households are depicted as larger nodes. As in many other Native communities, these high harvesting households in Sleetmute are active households headed by a mature married couple or an active single male. These households shared their harvests with other households, and received resources or services from other households, a pattern indicated by the many locations close to the center of the diagram (CL Brown et al. 2012).


INNOKO NATIONAL WILDLIFE REFUGE
INNOKO NWR WILDERNESS AREA
Grayling
Anvik
Shageluk
Iditarod
Flat
Holy Cross
Donlin Gold Project Site
Crooked Creek
Georgetown
Red Devil
Stony River
Sleetmute
Russian Mission
Aniak
Chuathbaluk
Upper Kalskag
Lower Kalskag
Napaimute
Lime Village
Tuluksak
Takotna
McGrath
Nikolai
310 300 290 280 270 260 250 240 230 220 210 200 190 180 120 110 100 90
MAP LOCATION
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
Subsistence Areas
Trout
Whitefish
Berries/Plants
Black Bear
Moose
Caribou
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: CL Brown et al. 2012
0 25 50 Miles
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, SLEETMUTE, 2009
JANUARY 2018
FIGURE 3.21-11


Donlin Gold Project Site
310
300
290
280
270
260
250
240
230
190
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Chuathbaluk
Napaimute
Lime Village
Kuskokwim River
Oskawalik River
Holokuk River
George River
East Fork George River
Moose Creek
Cheeneetnuk River
Swift River
Gagaryah River
Stony River
Slink River
Hoholitna River
Holitna River
Tundra Lake
Reindeer River
Reindeer Lake
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
MAP LOCATION
0
10
20
Miles
Salmon Subsistence Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: CL Brown et al. 2012
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, SALMON, SLEETMUTE, 2009
JULY 2017
FIGURE 3.21-12



Data Source: CL Brown et al. 2012

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, SLEETMUTE, 2009

JULY 2017 FIGURE 3.21-13

Variability: Between 2000 and 2009, data show that salmon harvests in Sleetmute fluctuated but slowly increased. After 2003, salmon harvests show a greater annual variation punctuated by declining or low per capita estimates in 2004, 2005, and 2007. There are various reasons for the variability, but ethnographic data collected in 2010 suggested that the increase in the salmon harvest was to compensate for loss of the availability of moose meat (CL Brown et al. 2012). While salmon harvests have increased the data show that harvests of burbot and Dolly Varden have declined in recent years. Residents reported that most non-salmon species were not fished as intensely as they once were and the current harvests of white fish and pike were now generally the result of incidental harvests during salmon fishing (CL Brown et al. 2012).

In the 1980s, moose were considered the primary source of protein for Central Kuskokwim communities and salmon an "alternate" resource (Stickney 1981; Charnley 1983, 1984). As in Nikolai, moose was prized above all other foods. In 2009, one Sleetmute resident said, "Certainly for us, living out here, moose have always been an integral part of what made life good out here" (CL Brown et al. 2012). Since the 1980s moose harvests in Sleetmute have declined precipitously from 134 pounds per person in 1983, to 69 pounds in 2003, to 0 in 2005 (CL Brown et al. 2012). In 2009, the per capita harvest was 35 pounds, but all households reported using less moose meat and not getting enough. Residents attributed the decline in moose to hunting pressure from non-local residents (particularly in GMU 18), and predation. They agreed with the closure in GMU 19A and but were conflicted about harvests to meet the community's need for moose meat and the criminalization of those hunts. They were also concerned that the data collected in 2010 was not representative and did not accurately represent community reliance on moose or the areas traditionally used to hunt moose (CL Brown et al. 2012). Residents pointed out that the areas now open to hunting were too far away making it a financial hardship to hunt. As one resident stated, "When you can't hunt locally it goes against many of the aspects which are fundamental about subsistence" (CL Brown et al. 2012). Residents said that if moose hunting were to reopen that it should be limited to local residents.

3.21.5.2.3 CROOKED CREEK

Crooked Creek is located on the north bank of the Kuskokwim River at its junction with Crooked Creek. It is 50 miles northeast of Aniak, 141 miles northeast of Bethel, and 275 miles west of Anchorage. In 2010, Crooked Creek had a population of 90. In 2010, researchers surveyed 33 of 40 households, reporting on harvests during 2009. Expanding for the seven unsurveyed households, Crooked Creek's estimated total harvest in 2009 was approximately 28,259 pounds or an average household harvest of 706 pounds (CL Brown et al. 2012). The average household income was $35,516 (CL Brown et al. 2012).

The seasonal round of harvest shows that food harvests are distributed widely across the year and across many species (Figure 3.21-14). Concentrated effort occurs in periods of optimal availability and primeness for food or furs. As examples, large mammals are taken in seasonal windows throughout the year, while fur-bearers are taken in winter. Salmon harvests are concentrated in the summer, along with many other fish species, while other fish species are taken in winter.

Figure 3.21-14: Crooked Creek Seasonal Round of Subsistence Harvests, 1964-1986

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Caribou	--	--																			--	--	--	--
Bears			--	--			--	--	--	--														
Moose	--	--									--	--									--	--		
Beaver																								
River otter																								
Lynx	--	--																						
Marten	--	--																						
Muskrat			--	--			--	--																
Red fox	--	--																						
Wolf	--	--																						
Wolverine	--	--																						
Chum and sockeye salmon					--	--					--	--												
Chinook salmon					--	--			--	--	--	--												
Coho salmon					--	--	--	--		--			--	--	--	--								
Burbot	--	--	--	--	--	--																	--	--
Dolly Varden	--	--	--	--	--	--	--	--							--	--								
Grayling	--	--															--	--			--	--	--	--
Lamprey											--	--												
Pike	--	--	--	--			--	--	--	--							--	--						
Sheefish			--	--							--	--	--	--										
Sucker																								
Whitefishes	--	--	--	--			--	--	--	--							--	--						
Grouse	--	--									--	--												
Porcupine	--	--	--	--			--	--	--	--	--	--			--	--	--	--	--	--	--	--	--	--
Ptarmigan	--	--																						
Snowshoe hare					--	--					--	--												
Waterfowl			--	--			--	--	--	--	--	--			--	--	--	--						
Other edible plants			--	--			--	--	--	--	--	--	--	--										
Non-edible plants																								
Berries							--	--	--	--					--	--								
Firewood																								

Notes:
Shaded cells denote concentrated use
-- denotes intermittent use
Source: Brelsford et al. 1987

Species Harvested and Used: Of households surveyed in Crooked Creek, 97 percent reported using a wild resource and 94 percent reported a harvest of wild foods. The most widely used resource category was vegetation (97 percent), followed by fish (94 percent), land mammals (79 percent), and birds and eggs (39 percent). In terms of specific resources used by households, wood was the most widely used resource (88 percent) followed by Chinook salmon (82 percent) berries (73 percent), chum (70 percent) and coho salmon (70 percent) (Table 3.21-6). Note, some residents said that 2009 was a "bad berry year" citing a warming environment and less rain (CL Brown et al. 2012).

Important examples of rate of harvesting resources include 70 percent of households that reported harvesting berries, 61 percent reported harvesting Chinook salmon, while 52 percent said they harvested sheefish, and 33 percent harvested beaver. Only 9 percent of households reported a harvest of moose. Very few households reported using caribou and there was no reported harvest of these animals (CL Brown et al. 2012).

Table 3.21-6: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Crooked Creek, 2009

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Salmon				
Chinook	82	61	30	30
Chum	70	55	18	21
Coho	70	55	21	24
Sockeye	67	55	24	21
Pink	6	6	3	0
Unknown salmon	0	0	0	0
Non-Salmon Fishes				
Sheefish	61	52	36	18
Smelt	3	0	0	3
Land Mammals				
Black bear	36	15	18	24
Caribou	6	0	0	6
Moose	64	9	12	58
Beaver	52	33	21	27
Hares	12	6	3	6
Muskrat	6	6	0	0
Marine Mammals				
Seals	6	0	0	6
Birds and Eggs				
Ducks	21	18	12	9
Geese	18	15	3	6
Upland birds	36	30	15	6

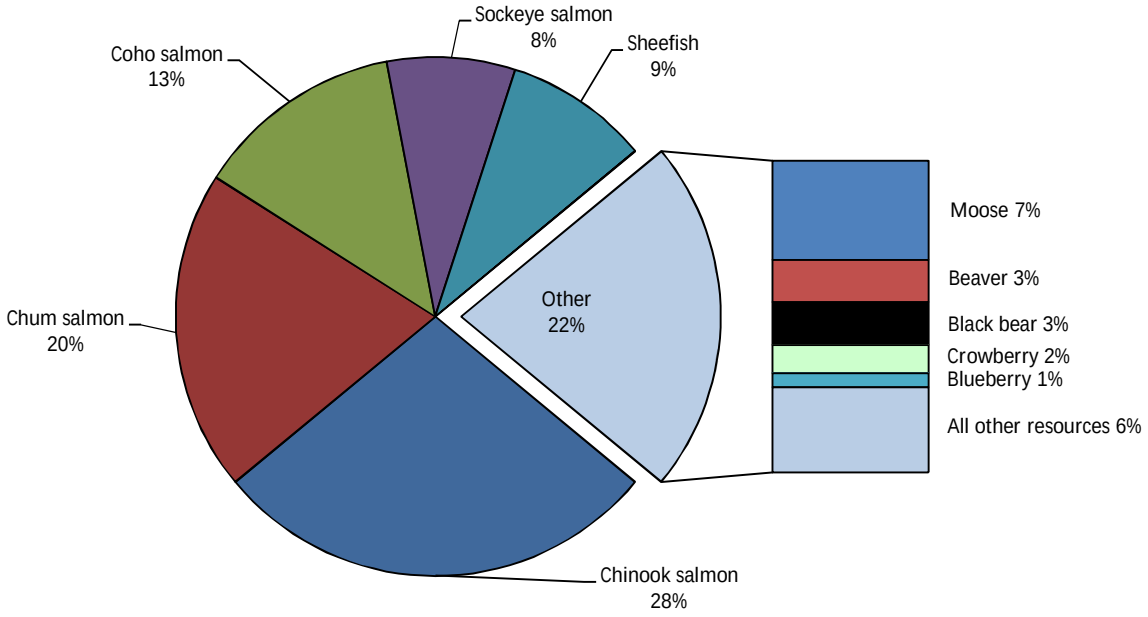
Table 3.21-6: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Crooked Creek, 2009

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Bird eggs	0	0	0	0
Vegetation				
Berries	73	70	42	12
Plants/greens/mushrooms	61	58	30	12
Wood	88	82	36	33

Notes:
Data based on surveys of 33 of 40 households in Crooked Creek
Source: CL Brown et al. 2012.

Five species of fish: Chinook, chum, coho, sheefish, and sockeye salmon accounted for 78 percent of the total subsistence harvest in 2009. The remaining 22 percent was made up of Moose (7 percent), black bear (3 percent) and beaver (3 percent), various species of berries and other resources, such as birds, marine mammals, and marine invertebrates (Figure 3.21-15).

Figure 3.21-15: Composition of Crooked Creek Subsistence Harvest by Estimated Edible Weight, 2009



Source: CL Brown et al. 2012

Harvest Areas: Residents of Crooked Creek reported using almost 1,246 square miles for subsistence activities in 2009 (CL Brown et al. 2012) (see Figure 3.21-16). According to residents, the area documented in 2009 did not represent their entire traditional territory, which was much broader, and had been affected by regulations, changes in the environment and local animal populations, as well as economic considerations, such as the price of gasoline. Closure of moose hunting in GMU 19A, followed by a limited permit hunt, has curtailed moose hunts above the George River and the Holitna and Hoholitna basins (CL Brown et al. 2012). In recent years, moose have been hunted further down river and further to the north and west of the community in the Bonanza flats and Donlin Creek areas (CL Brown et al. 2012). Moose hunting in the Bonanza flats and Donlin Creek areas was not shown in mapped use areas in 2009.

Land mammals were harvested over a large area including the mainstem of the Kuskokwim River and its tributaries both downstream and upstream from the village. Hunting areas for many species overlapped. Crooked Creek hunters said they hunted for moose on the mainstem of the Kuskokwim River as far down river as the community of Lower Kalskag and as far upriver as the George River. Particular tributaries of the Kuskokwim used for moose hunting were the Holitna, Hoholitna and George rivers. Black bears were hunted primarily along Crooked Creek and in the Oskawalik River (Figure 3.21-16). Beaver were hunted along parts of Crooked Creek and on the George River (CL Brown et al. 2012).

A majority of fish was harvested with gillnets (78 percent), while rod and reel accounted for 20 percent of the total fish harvest. Fish were also harvested with jigs used during the winter through a hole in the ice. Salmon were harvested primarily in the mainstem of the Kuskokwim River from just below the mouth of the Oskawalik River upstream to the mouth of George River, with the heaviest fishing taking place along the Great Bend (Figure 3.21-17). Non-salmon fish species were also harvested in the mainstem of the Kuskokwim, but specific species such as Arctic Grayling were harvested up the George River or in Crooked Creek, particularly at the confluence of Crooked Creek and the Kuskokwim. Sheefish were harvested in the spring primarily in the Great Bend in front of the village (CL Brown et al. 2012).

Berry and plant harvesting took place both near the community and in areas within one day's travel by boat. Some respondents reported going farther than usual in 2009 to harvest greens and berries. Some popular locations were in the Canoe Hills area and in the hills directly across the Kuskokwim River from the community. Some residents reported traveling by boat downstream to an area between the Oskawalik River and Napaimute, and as far upstream as midway between the George River and the community of Red Devil (CL Brown et al. 2012).

Firewood is also an important subsistence resource, with harvest of 237 cords documented for 2009. Use areas for gathering firewood were not documented in 2009. Comments on the Draft EIS included information that firewood has been harvested in recent years from the Mine Site vicinity. For the mid-1980s, an earlier study reported that wood lots are located along Crooked Creek and the Kuskokwim River in close proximity to the village. Driftwood is harvested extensively in the spring and late summer during periods of high water (Brelsford et al. 1987).

Sharing: In most Kuskokwim communities, households use wild foods that are harvested by others and distributed through sharing networks. For this reason, the percentage of households harvesting is usually lower than the percentage using. In Crooked Creek, 29 percent of the households harvested 70 percent of the wild resources. The highest producing households in Crooked Creek were several mature households with male and female heads, represented by

large red squares, and one single male household, represented by a triangle in the lower section of the diagram (Figure 3.21-18).

Variability: While a majority of Crooked Creek residents interviewed by ADF&G staff in 2010 reported that they "got enough" wild foods in 2009, 42 percent of households said they did not get enough salmon. Residents attributed the shortage of salmon to various factors including increased commercial fishing, and a lack of money, gear, or time to go fishing. Residents pointed out that summer salmon fishing conflicted with periods of high employment when residents left the community to work. According to data collected by ADF&G, the 2009 salmon harvest was lower than previous years but still the third highest since 2000 (CL Brown et al. 2012).

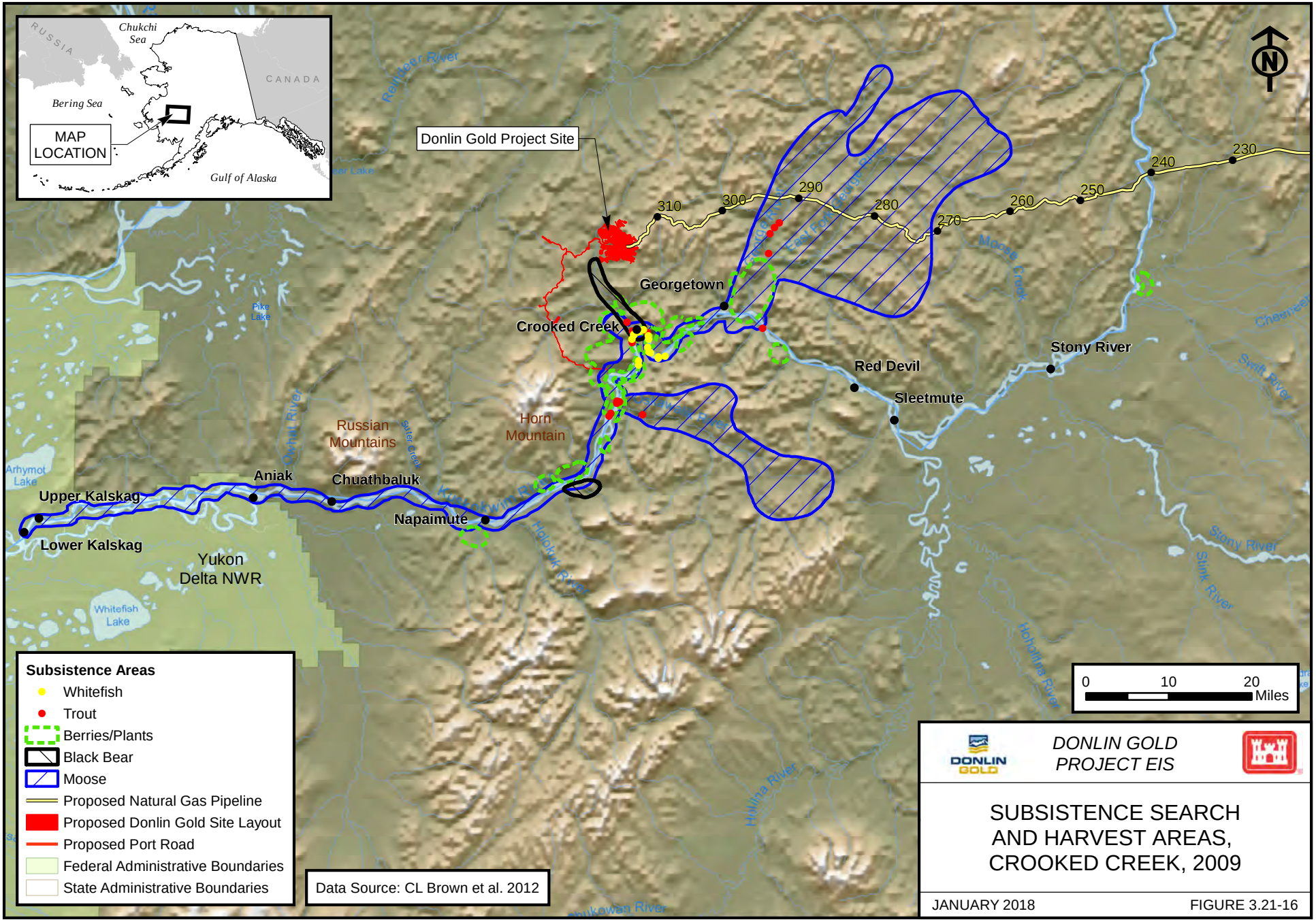
Some residents also said they did not get enough moose or caribou in 2009. Residents did not report a harvest of caribou but said they received caribou meat from friends. Residents said that caribou were more plentiful in the past and attributed the change to changes in migration routes, and to low-flying aircraft that diverted the herds (CL Brown et al. 2012). Noise pollution was also a reason given for residents not getting enough birds and eggs and for the decline in moose.

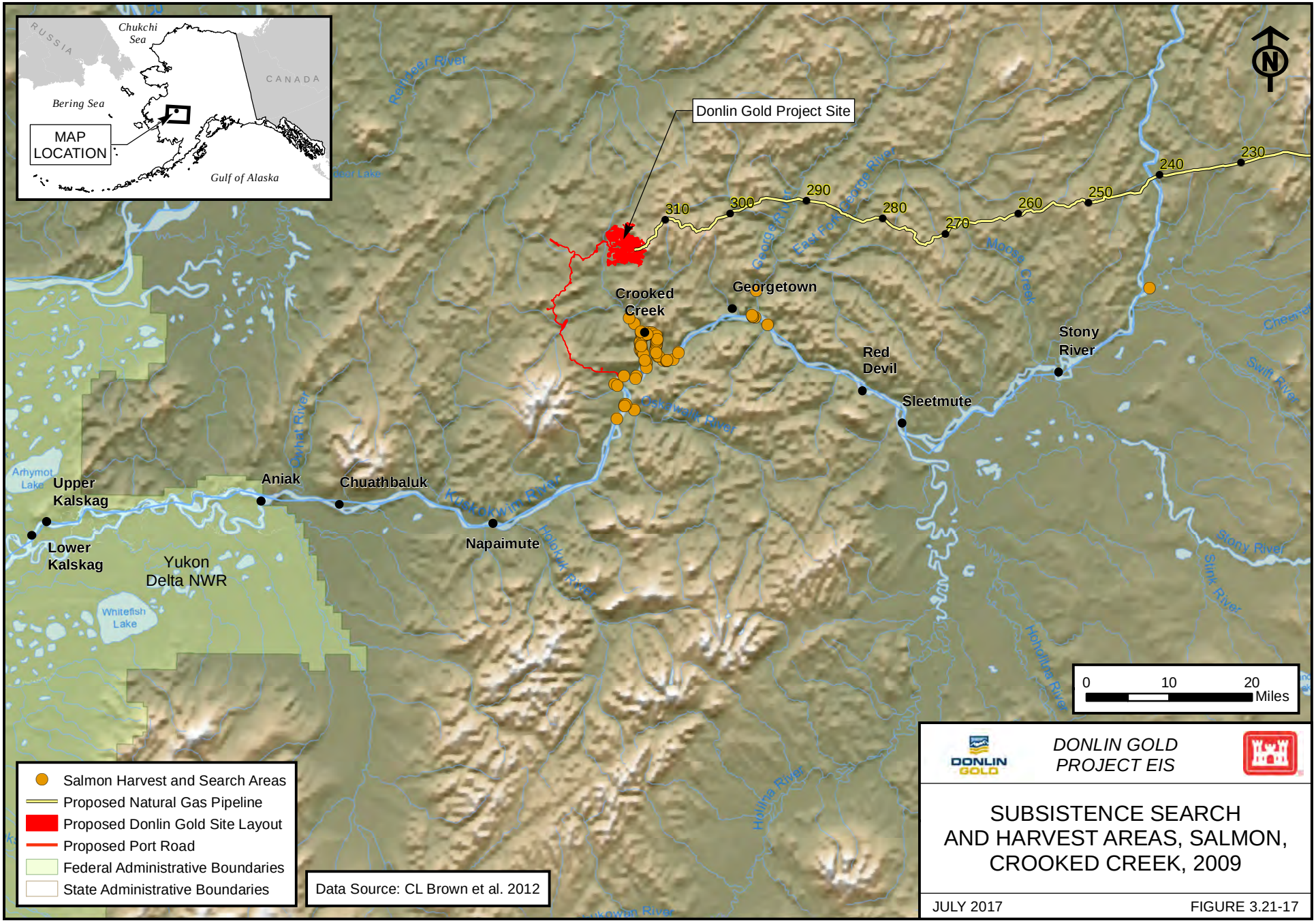
Many residents felt that moose populations were on the decline near Crooked Creek. One resident thought the decline in moose population was due to competition from non-local hunters, lack of predator control, and increased noise from motorized vehicles such as boats, planes, and all-terrain vehicles. Data on subsistence moose harvests for 2003, 2004, 2005, and 2009 show them to be highly variable. Harvests in 2009 were consistent with 2004 levels (CL Brown et al. 2012).

3.21.5.2.4 ANIAK

Aniak is the largest community in the Central Kuskokwim region located about 317 miles west of Anchorage and 92 miles from Bethel. By virtue of its size and infrastructure, Aniak serves as a hub for several nearby smaller communities. The population of Aniak is primarily Yup'ik. In 2009, the population was estimated at 502 people. In 2009, researchers from ADF&G surveyed 141 of 170 households in Aniak. Expanding for the 29 unsurveyed households, Aniak's estimated total wild food harvest was 147,316 pounds with an average household harvest of 1,498 pounds. The average household income was $58,018 (CL Brown et al. 2012).

Species harvested and used: Aniak households used an average of 10 subsistence resources during 2009 and harvested and average of 8. The most widely used resource category was fish (92 percent), which was also the resource most commonly harvested (79 percent). The next most widely used resource categories were vegetation (80 percent) and land mammals (76 percent). Forty-eight percent of households said they used birds and eggs. Percentages of Aniak households using, harvesting, giving, and receiving specific subsistence resources are shown in Table 3.21-7.


MAP LOCATION
Chukchi Sea
RUSSIA
CANADA
Bering Sea
Gulf of Alaska
Donlin Gold Project Site
310
300
290
280
270
260
250
240
230
Georgetown
Crooked Creek
Red Devil
Sleetmute
Stony River
Aniak
Chuathbaluk
Napaimute
Upper Kalskag
Lower Kalskag
Russian Mountains
Horn Mountain
Yukon Delta NWR
Kuskokwim River
Holokuk River
Hoholitna River
Stony River
Swift River
Moose Creek
Pike Lake
Arhymot Lake
Whitefish Lake
Oshetl River
Reindeer River
Subsistence Areas
Whitefish
Trout
Berries/Plants
Black Bear
Moose
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: CL Brown et al. 2012
0
10
20
Miles
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, CROOKED CREEK, 2009
JANUARY 2018
FIGURE 3.21-16


RUSSIA
Chukchi Sea
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MAP LOCATION
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Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Aniak
Chuathbaluk
Napaimute
Upper Kalskag
Lower Kalskag
Yukon Delta NWR
Arhymot Lake
Whitefish Lake
Reindeer River
George River
East Fork George River
Moose Creek
Oskawalik River
Kuskokwim River
Holokuk River
Stony River
Stink River
Hoholitna River
Swift River
Salmon Harvest and Search Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: CL Brown et al. 2012
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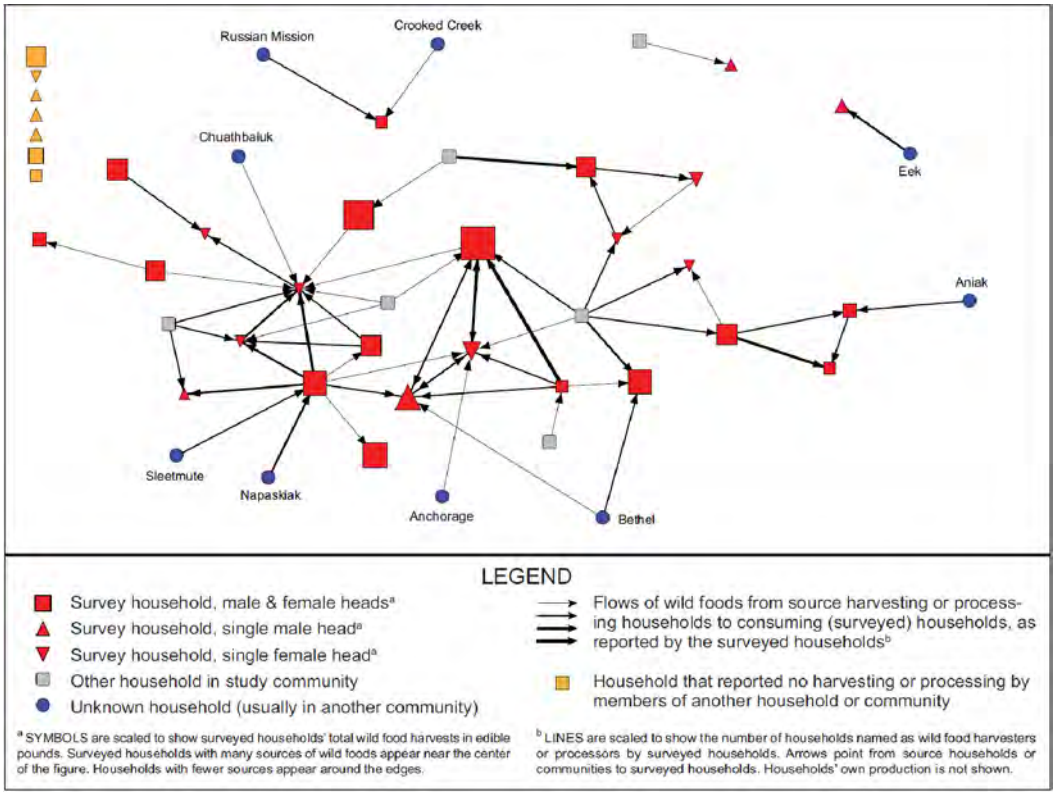
Miles
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, SALMON, CROOKED CREEK, 2009
JULY 2017
FIGURE 3.21-17



Data Source: CL Brown et al. 2012

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, CROOKED CREEK, 2009

JULY 2017

FIGURE 3.21-18

Table 3.21-7: Estimated Use, Harvest, Giving and Sharing of Subsistence Resources by Category and Selected Species, Aniak, 2009

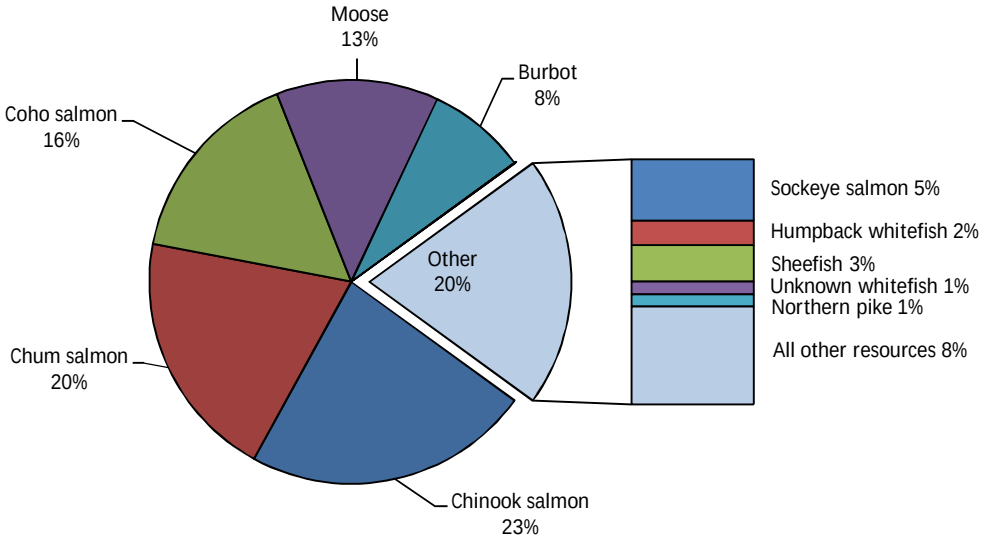
	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Salmon	**91**	**77**	**40**	**48**
Chinook	79	61	30	39
Chum	40	35	12	9
Coho	81	69	21	32
Sockeye	50	40	14	17
Pink	6	6	1	1
Non-Salmon Fishes				
Sheefish	29	21	6	14
Burbot	13	7	4	9
Land Mammals	**76**	**31**	**30**	**62**
Black bear	11	6	3	7
Caribou	8	1	2	6
Moose	72	21	24	57
Beaver	13	8	4	8
Snowshoe hare	9	8	3	3
Muskrat	3	3	0	0
Marine Mammals	**16**	**1**	**4**	**16**
Beluga whale	3	1	1	2
Seals	15	0	1	15
Birds and Eggs	**48**	**38**	**16**	**21**
Ducks	28	21	9	10
Geese	18	13	5	8
Upland birds	38	33	8	13
Bird eggs	1	1	0	1
Vegetation	**80**	**73**	**28**	**45**
Berries	65	55	21	33
Plants/greens/mushrooms	37	37	10	10
Wood	45	39	7	12

Notes:
Data based on surveys of 141 of 170 households in Aniak
Source: CL Brown et al. 2012

Both salmon and non-salmon species of fish made up the largest percentage (82 percent) of the Aniak subsistence harvest in 2009. Nine out of the top ten species harvested were Chinook, chum, coho, and sockeye salmon; burbot; humpback whitefish; sheefish; unknown whitefish; and northern pike (Figure 3.21-19). Fishing for Chinook salmon usually peaks in the second and third weeks of June and ends in early July. Households that did not catch enough Chinook will usually target other species of salmon, but those other species have less oil content and dry differently. In addition, fishing later means that households run the risk of processing fish when flies are abundant, and rain is more likely (CL Brown et al. 2012). Chinook salmon are preferred over all other species of salmon for their size and oil content.

> Basically, we're going after [Chinook] and then as bycatch we're catching reds [sockeye] and chum. We use some silvers [coho], but basically our number one priority is [Chinook]. Because of the oil content. They're bigger. You catch one and it's like catching five smaller fish. It is the premium fish, our choice (quoted in CL Brown et al. 2012).

Figure 3.21-19: Composition of Aniak Subsistence Harvest by Estimated Edible Weight, 2009



Source: CL Brown et al. 2012

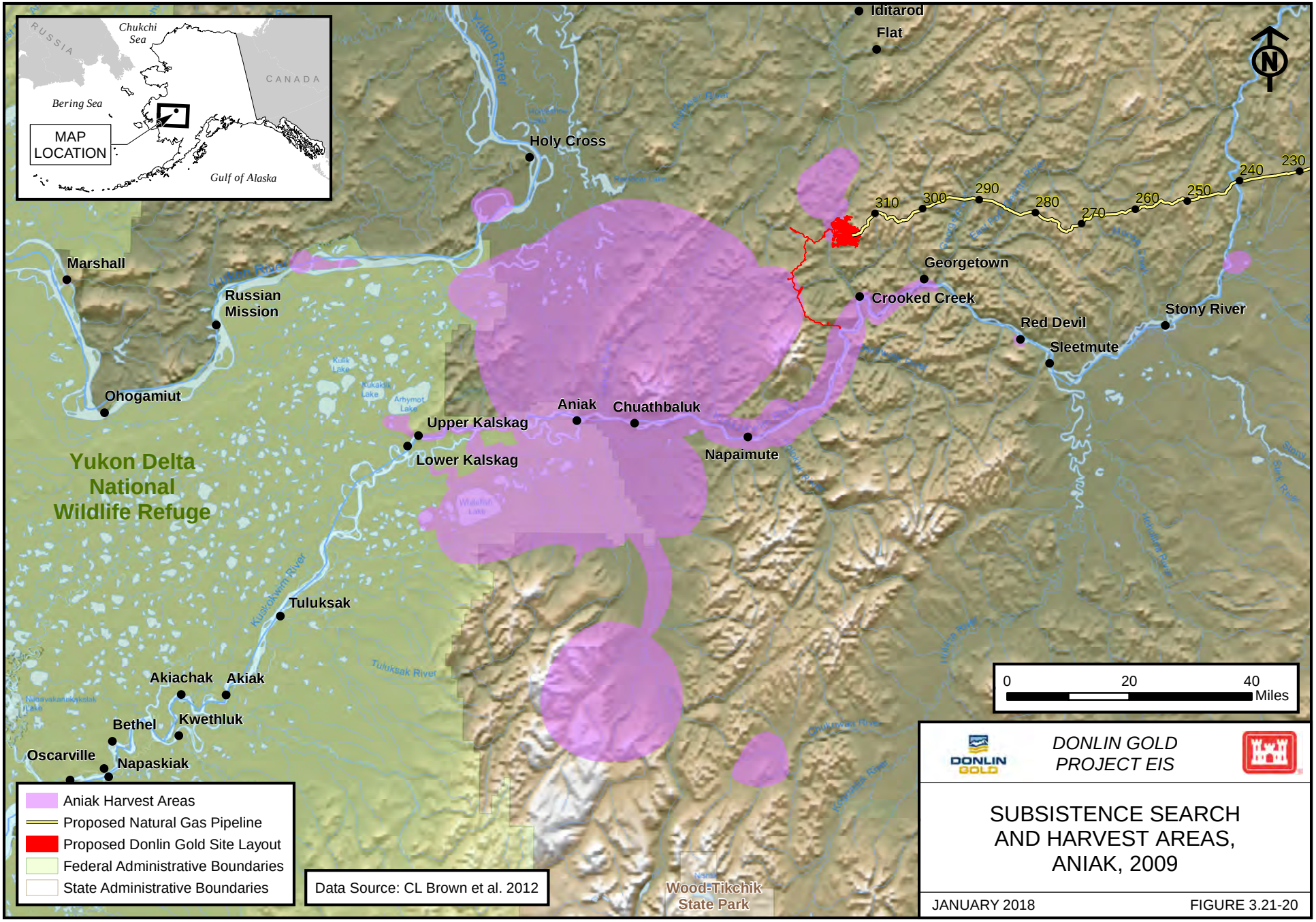
Land mammals, primarily moose and black bears, contributed 15 percent to the total harvest, while vegetation contributed another 2 percent and marine mammals, birds and eggs, and marine invertebrates each supplied less than one percent (CL Brown et al. 2012).

Harvest areas: In 2009, Aniak residents reported using a harvest area of 3,396 square miles (Figure 3.21-20). The Kuskokwim and Aniak rivers figure prominently in subsistence activities as both harvest locations and transportation corridors. Households reported traveling as far up the Kuskokwim at the mouth of the George River. On the Aniak River, the community use area extended past the confluence of the Aniak, Salmon, and Kipchuk rivers. South and west of the community residents reported hunting and fishing in the vicinity of Whitefish Lake and the Buckstock Mountains.

Residents reported harvesting salmon in the mainstem of the Kuskokwim River east and west of the community, with additional areas along the Aniak River. Non-salmon fish species were harvested along the Aniak River and Whitefish Lake.

Aniak residents reported ranging over a wide area to hunt moose, caribou, and black bear. The extent of moose hunting may be a response to different game management strategies in different subunits of GMU 19. In GMU 19A, moose are managed more conservatively than in GMU 19B. People reported hunting moose to the north in GMUs 21A and 21E towards Paimiut Slough and the Iditarod River drainage (CL Brown et al. 2012).

Sharing: Sharing, measured in terms of households giving and receiving subsistence food, was highest for Chinook salmon and moose with large numbers of Aniak households reportedly receiving these resources (Table 3.21-7) (CL Brown et al. 2012).


Iditarod
Flat
Holy Cross
Marshall
Russian Mission
Ohogamiut
Yukon Delta National Wildlife Refuge
Aniak
Chuathbaluk
Upper Kalskag
Lower Kalskag
Napaimute
Georgetown
Crooked Creek
Red Devil
Sleetmute
Stony River
Tuluksak
Akiachak
Akiak
Bethel
Kwethluk
Oscarville
Napaskiak
Wood-Tikchik State Park
MAP LOCATION
Chukchi Sea
Bering Sea
Gulf of Alaska
RUSSIA
CANADA
Aniak Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: CL Brown et al. 2012
0 20 40 Miles
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, ANIAK, 2009
JANUARY 2018
FIGURE 3.21-20

Aniak residents said that traditional values still hold, including the respectful treatment of animals, avoiding waste, taking care of one's harvest, and sharing – particularly with those unable to harvest subsistence food themselves. The practice of giving away a young hunter's first harvest is still observed in some families (CL Brown et al. 2012). Figure 3.21-21 illustrates the flow of wild foods between households within Aniak and with numerous other communities in Alaska. In Aniak, the largest producing household, represented by the large red square in the middle of the figure, had both a female and male head.

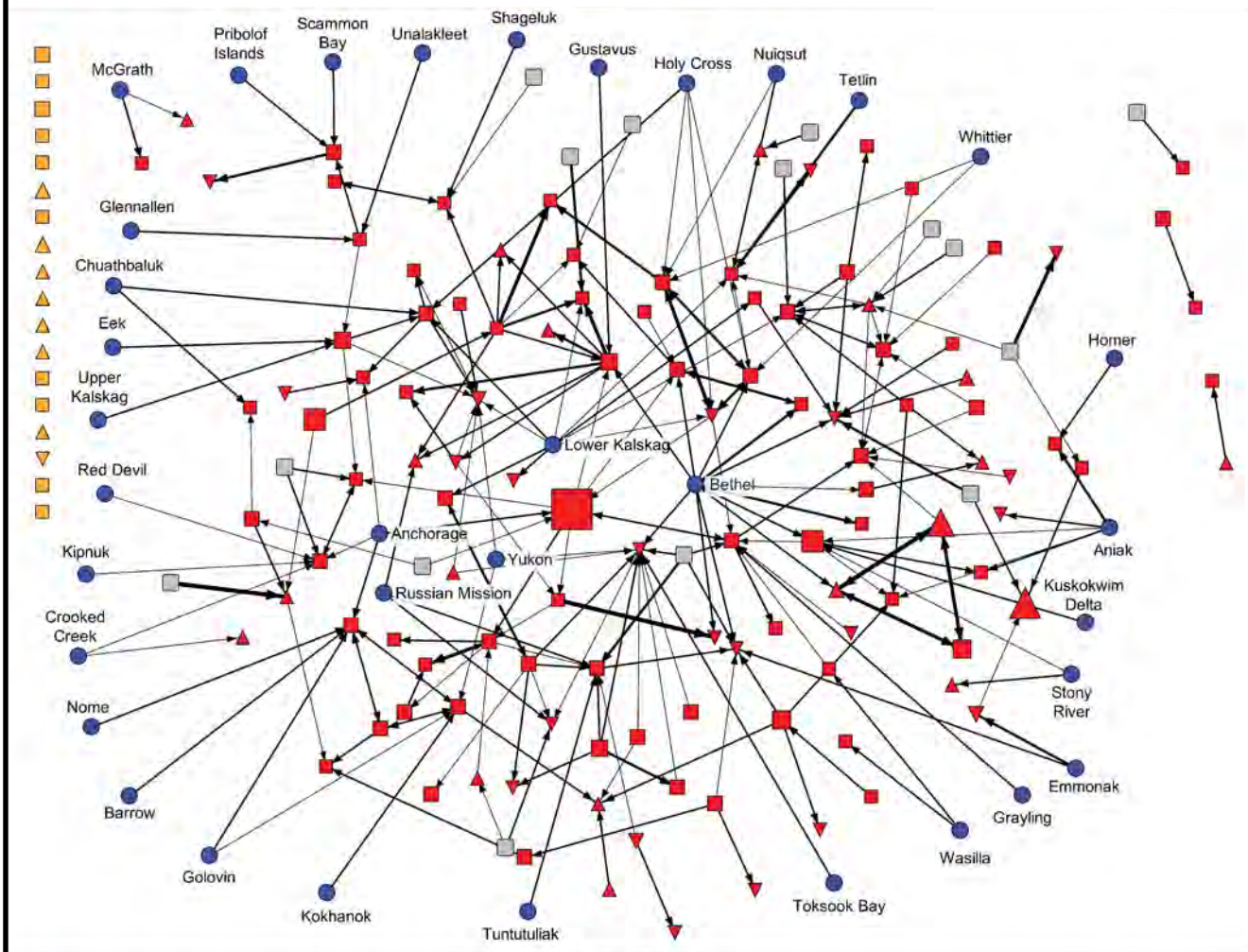
Concerns: For all resource categories, most respondents said they got enough subsistence foods in 2009. However, over 50 percent of respondents reported not getting enough moose, caribou, or greens and berries. Most respondents cited resource availability as the reason for not getting enough of these resources (CL Brown et al. 2012).

Moose populations in the Central Kuskokwim have experienced heavy hunting pressure form locals, nonlocal Alaska residents, and nonresidents. Aniak residents generally agreed the moose population was rebounding but the large number of hunters in the fled makes it difficult to harvest a moose.

> Every day in the whole world can come over here and hunt while we're trying to hunt. It makes it harder for us people who are living here, to go out in our own country to go find moose. Everywhere we go, there's camps where we hunt year round. Every fall time, we try to go hunting, in the areas we show you, there's camps. They go way back, they fly. One year, two years in a row, we didn't get moose. We got meat lower 48 people who came to hunt. Half the time we had to throw away the meat. It wasn't taken care of, it was spoiled (quoted in CL Brown et al. 2012).

All residents who participated in the ADF&G survey in 2009 said that the size and abundance of Chinook salmon had decreased in recent decades. One resident said that since the 1960s both Chinook and chum salmon seemed to have declined (CL Brown et al. 2012).

> The [Chinook], there are not as many and they are not as big right now compared to when I was a teenager. Big [Chinook], those were easy to get. At my dad's, our fish camp growing up, the smokehouse would fill up in 4 days and we'd be done with [Chinook] fishing. Now you have to fish from 2-3 weeks to get what you need (quoted in CL Brown et al. 2012).



LEGEND

- Survey household, male & female heads[a]
- Survey household, single male head[a]
- Survey household, single female head[a]
- Other household in study community
- Unknown household (usually in another community)

[a] SYMBOLS are scaled to show surveyed households' total wild food harvests in edible pounds. Surveyed households with many sources of wild foods appear near the center of the figure. Households with fewer sources appear around the edges.

- Flows of wild foods from source harvesting or processing households to consuming (surveyed) households, as reported by the surveyed households[b]
- Household that reported no harvesting or processing by members of another household or community

[b] LINES are scaled to show the number of households named as wild food harvesters or processors by surveyed households. Arrows point from source households or communities to surveyed households. Households' own production is not shown.

Data Source: CL Brown et al. 2012

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, ANIAK, 2009

JANUARY 2018 FIGURE 3.21-21

3.21.5.2.5 CHUATHBALUK

Chuathbaluk is located on the north bank of the Kuskokwim River, 11 miles upstream from Aniak and 87 air miles from Bethel. In 2009, the estimated population was 122 people. In 2010, researchers from the ADF&G surveyed 30 of the 36 households in Chuathbaluk. Expanding for the six unsurveyed households Chuathbaluk's estimated total harvest was 29,874 pounds with an average household harvest of 829 pounds. The average household income was $28,522 (CL Brown et al. 2012).

Species harvested and used: One hundred percent of Chuathbaluk households reported using a subsistence resource in 2009 and 93 percent reported harvesting a resource. Fish were the most widely used resource category (97 percent) followed by vegetation (87 percent), land mammals (80 percent), and birds and eggs (57 percent). The most widely harvested resources were vegetation, fish, birds and eggs, and land mammals respectively. Over 60 percent of the total harvest was composed of various species of salmon. The most widely used salmon species was Chinook, followed by sockeye, coho, and chum (Table 3.21-8).

Table 3.21-8: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Chuathbaluk, 2009

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Salmon				
Chinook	90	60	23	47
Chum	67	57	17	27
Coho	77	60	20	43
Sockeye	83	60	27	40
Pink	10	0	0	10
Non-Salmon				
Sheefish	67	43	20	30
Smelt	27	7	7	20
Land Mammals				
Black Bear	23	7	10	17
Caribou	27	3	3	23
Moose	77	20	23	60
Beaver	30	20	7	17
Hare	10	3	3	7
Muskrat	0	0	0	0
Marine Mammals				
Beluga whale	0	0	0	0
Seals	23	0	0	23
Birds and Eggs				
Ducks	40	20	7	20

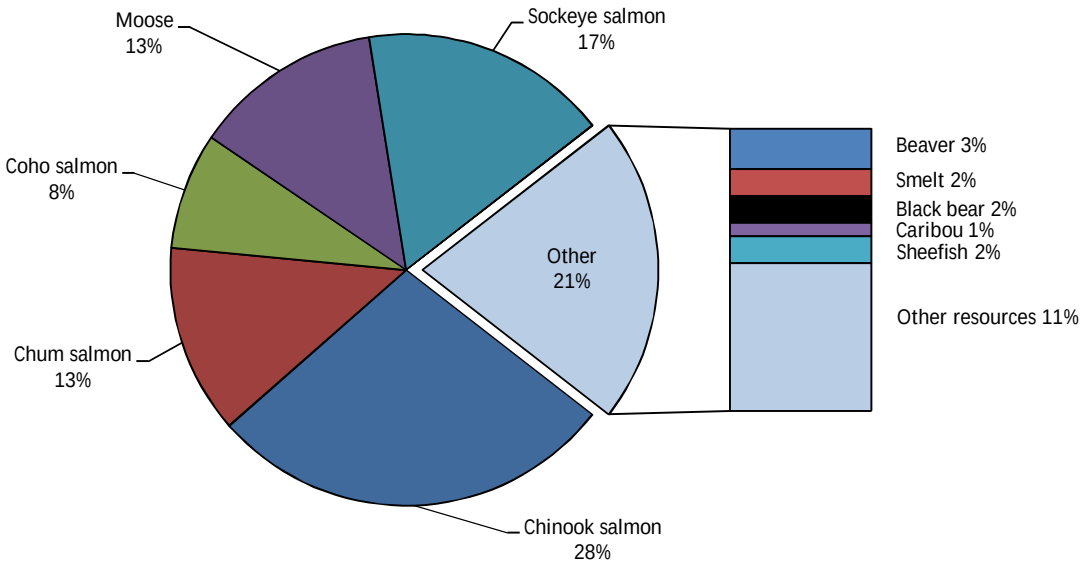
Table 3.21-8: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Chuathbaluk, 2009

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Geese	33	23	7	13
Grouse/ptarmigan/other birds	40	33	10	7
Eggs	3	0	0	3
Vegetation				
Berries	80	63	20	33
Plants/greens/mushrooms	53	53	20	0
Wood	67	67	7	10

Notes:
Data based on surveys of 30 of the 36 households in Chuathbaluk
Source: CL Brown et al. 2012

Moose made up 13 percent of the total harvest but was used by over 70 percent of households. Other resources harvested and used by the community included beaver, smelt, sheefish, black bear, and caribou (Figure 3.21-22). Residents reported that moose is a very important source of protein and provides some measure of economic relief since households that do not harvest or receive moose meat have to purchase meat for the winter (CL Brown et al. 2012). Other sources of meat are beaver, black bear, and caribou, but caribou are relatively scarce; the community harvested only four animals in 2009.

Figure 3.21-22: Composition of Chuathbaluk Subsistence Harvest by Estimated Edible Weight, 2009



Source: CL Brown et al. 2012

Harvest areas: In 2009, Chuathbaluk residents reported using a harvest area of almost 983 square miles (Figure 3.21-23). Land use as reported by residents in 2009 was confined primarily to the mainstems of the Kuskokwim, Aniak and Holokuk rivers, as well as Victoria and Suter creeks (CL Brown et al. 2012). Salmon search and harvest locations were documented for an area 5 miles upriver of the community to 6 miles below on the mainstem of the Kuskokwim River. Salmon were also harvested in the vicinity of Napaimute and in Aniak Slough. Whitefish, rainbow / steelhead trout harvest locations are very similar to those used for salmon.

Comments on the Draft EIS noted that residents have fish camps above and below Chuathbaluk. Net fishing locations in the vicinity of Chuathbaluk are shown in Figure 3.21-66C. For the early 1980s, nine Chuathbaluk resident fish camp locations were mapped along the Kuskokwim River from Upper Kalskag to just above Napaimute (Charnley 1984). As fish camp use has generally declined in recent decades, not all of these are likely to be currently active.

Chuathbaluk residents said they ranged over a wide area to hunt moose, caribou, and black bear. Caribou were harvested in an area to the southwest of Aniak and east of Whitefish Lake. Black bear were hunted on the north and south banks of the Kuskokwim upriver of Napaimute. Moose were hunted along the river corridor of GMU 19A as well as in the Holokuk River drainage south of the Kuskokwim River, in the Russian Mountains, Suter and Kolamokof rivers to the north of the Kuskokwim (CL Brown et al. 2012).

Berries and vegetation were harvested in an extensive area, including an area around the Russian Mountains north of the village.

Sharing: As measured in terms of households giving and receiving subsistence food, sharing was highest for fish and land mammals. Almost 90 percent of Chuathbaluk households reported receiving wild foods while 60 percent reported giving away a resource (CL Brown et al. 2012). Figure 3.21-24 illustrates the flow of wild foods between households within Chuathbaluk or received from other communities within Alaska. The figure shows the distribution of subsistence foods from certain high harvesting households. In Chuathbaluk, the two highest food-producing households were a mature household composed of a man and wife with substantial income, and a single female-headed household (CL Brown et al. 2012).

Concerns: In 2009, a majority of respondents said they got enough subsistence resources with the exception of vegetation. Just over 60 percent of respondents said they did not get enough berries and several respondents said the effect on their households was either major or severe (CL Brown et al. 2012).

When asked about salmon abundance over time respondents gave various answers. One man summarized the view of many middle aged and elderly residents:

> Fishing was good early in the 80s, 70s. Nobody was having a hard time; they could be catching fish right away. Fishing was great, all the way from the 70s to the 90s. Middle 90s we started to see a lot of changes. It is just getting harder and harder trying to live a subsistence lifestyle, but there are a lot of us that still do it (CL quoted in Brown et al. 2012).

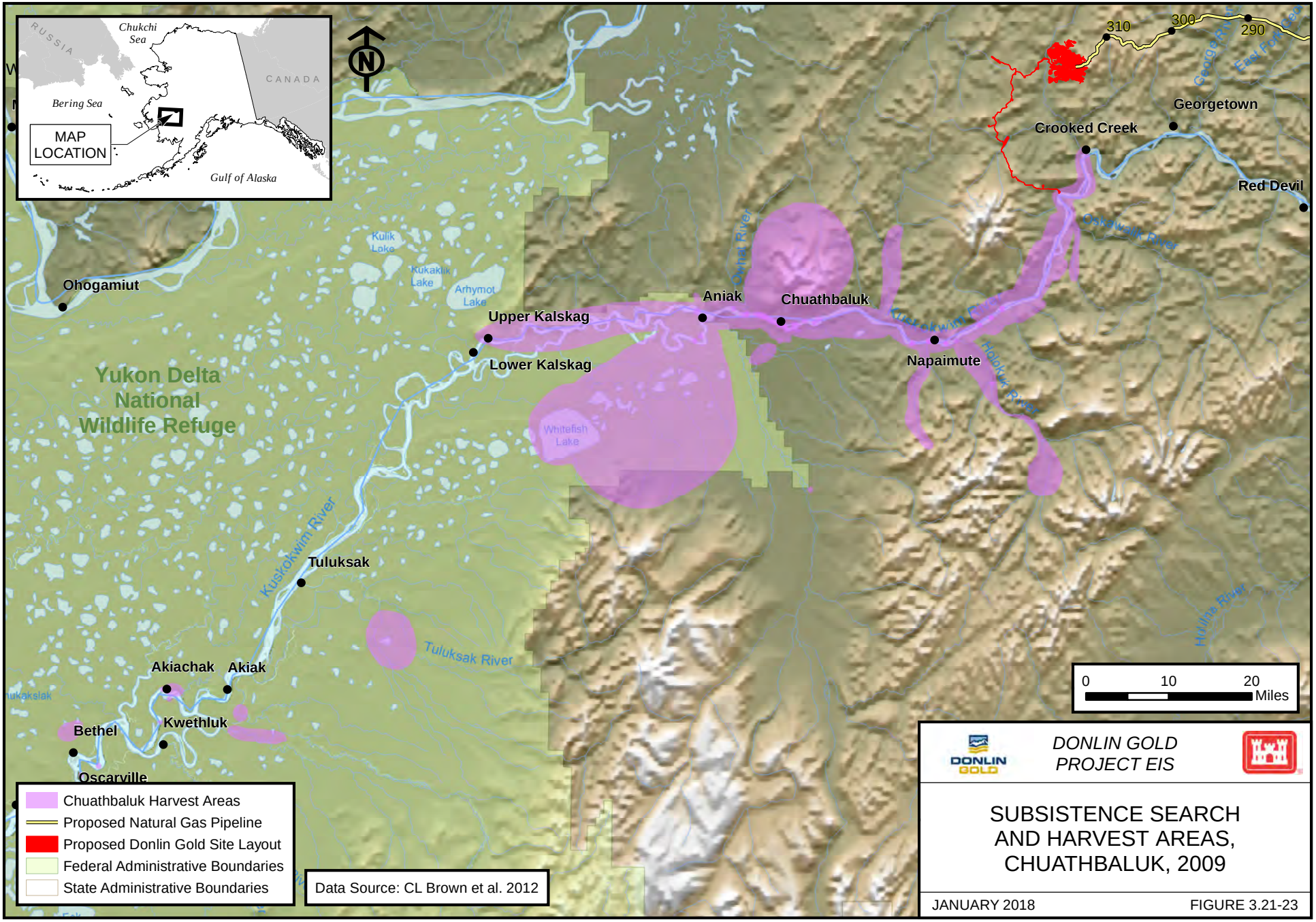
The most prominent change in the subsistence harvest over the past 30 years has been the decline in moose as a substantial component of the community's diet. Several residents said that moose populations have steadily declined since about the mid-1990s. Hunting effort and the distance traveled has also increased. Moose are now more elusive and avoid waterways used

for hunting. Most residents agreed that predation from wolves and bears has been a growing factor since the 1990s. Black bear harvests have experienced a similar decline, though not as sharp as moose. Prior to the 1990s caribou was an important source of meat but since then caribou harvests have steadily declined.

3.21.5.3 SUBSISTENCE HARVEST PATTERNS: LOWER-MIDDLE KUSKOKWIM SUBREGION

The lower-middle Kuskokwim subregion includes the communities of Tuluksak, Akiak, Akiachak, Kwethluk, Oscarville, Napaskiak, Napakiak, Atmautluak, Kasigluk, Nunapitchuk, and Bethel, the regional center. In 2011, ADF&G Division of Subsistence undertook harvest surveys in Oscarville, Kwethluk, Akiak, and Tuluksak (Brown et al. 2013). This research was Phase II in the Donlin Gold Subsistence Research Program. Research in Bethel took place in 2013 when the Division of Subsistence conducted a household survey to collect data for the 2012 study year (Runfola et al. 2017). No data on the subsistence practices of Atmautluak and Kasigluk are available. Bethel and Kwethluk were selected as example communities for this subregion.

Residents of the lower-middle Kuskokwim River region described a long tradition of engaging in subsistence activities and many said that access to subsistence resources was essential to maintaining their cultural heritage, family, and community ties. The current harvest patterns of Oscarville, Kwethluk, Akiak, and Tuluksak largely reflect historical patterns of the lower-middle Kuskokwim region typified by a diverse resource base with heavy reliance on fish and land mammals supplemented by harvests of marine mammals, migratory birds and eggs, and a wide variety of plants. Fish were an important resource, providing between 63 and 82 percent of the subsistence harvest by edible weight for each surveyed community. Per capita harvests range from 166 pounds in Bethel to 1,328 pounds in Akiachak (Table 3.21-9).


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
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Crooked Creek
Red Devil
Kuskokwim River
Ohogamiut
Kulik Lake
Kukaklik Lake
Arhymot Lake
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Holokuk River
Whitefish Lake
Yukon Delta National Wildlife Refuge
Tuluksak
Tuluksak River
Akiachak
Akiak
Bethel
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Oscarville
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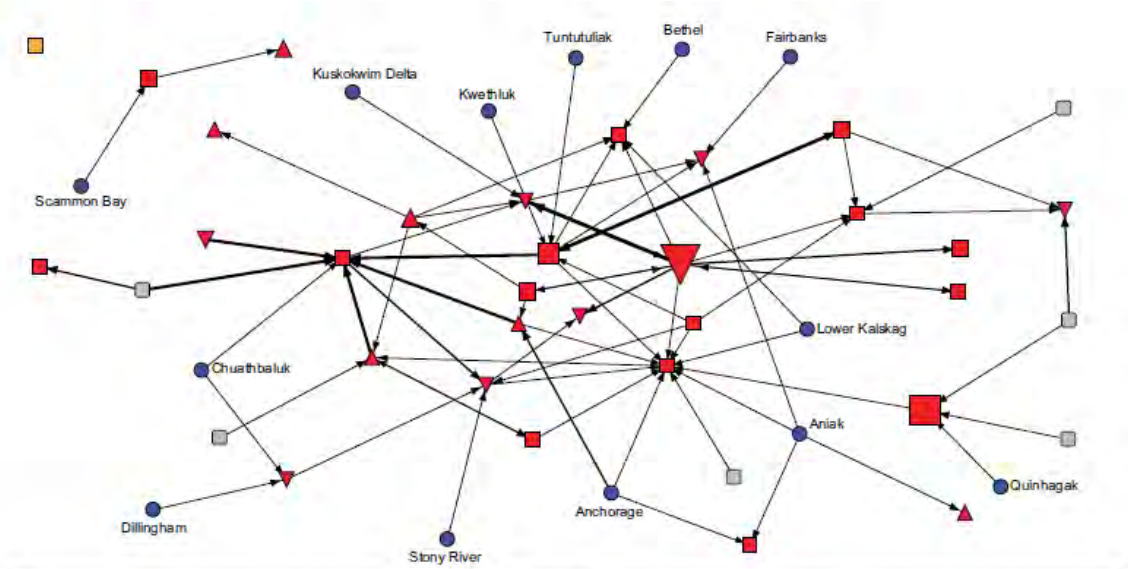
Miles
Chuathbaluk Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: CL Brown et al. 2012
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, CHUATHBALUK, 2009
JANUARY 2018
FIGURE 3.21-23



LEGEND

- Survey household, male & female heads[a]
- Survey household, single male head[a]
- Survey household, single female head[a]
- Other household in study community
- Unknown household (usually in another community)
- Flows of wild foods from source harvesting or processing households to consuming (surveyed) households, as reported by the surveyed households[b]
- Household that reported no harvesting or processing by members of another household or community

[a] SYMBOLS are scaled to show surveyed households' total wild food harvests in edible pounds. Surveyed households with many sources of wild foods appear near the center of the figure. Households with fewer sources appear around the edges.

[b] LINES are scaled to show the number of households named as wild food harvesters or processors by surveyed households. Arrows point from source households or communities to surveyed households. Households' own production is not shown.

Data Source: CL Brown et al. 2012

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, CHUATHBALUK, 2009

JULY 2017

FIGURE 3.21-24

Table 3.21-9: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Nine Lower-Middle Kuskokwim Subregion Communities

Community	Bethel	Tuluksak	Akiak	Akiachak	Kwethluk	Nunapitchuk	Oscarville	Napakiak	Napaskiak
Reference Year	**2012**	**2010**	**2010**	**1998**	**2010**	**1983**	**2010**	**2011**	**2011**
All Resources	**165.8**	**359.3**	**615.7**	**1,328.28**	**364.1**	**801.91**	**520.6**	**489.4**	**409.9**
Marine Mammals	**3.6**	**5.9**	**5.7**	**30.70**	**24.9**	**19.68**	**14.0**	**9.2**	**29.0**
Seals	2.2	2.9	1.6	18.72	17.4	19.68	14.0	9.2	13.3
Walrus	1.4	3.1	4.0	9.19	5.1	--	0.0	0.0	15.7
Whale	0.0	0.0	0.0	2.79	2.3	--	0.0	0.0	0.0
Large Land Mammals	**43.3**	**34.4**	**57.3**	**244.53**	**47.9**	**21.17**	**41.7**	**50.1**	**61.1**
Bison	0.0	--	--	--	--	--	--	0.0	0.0
Black bear	0.4	1.7	1.1	10.45	1.2	2.25	0.0	0.0	0.0
Brown bear	0.2	0.4	0.0	2.79	1.3		0.0	0.0	0.0
Caribou	8.6	8.3	18.6	85.91	20.2	--	21.7	19.8	17.7
Dall sheep	0.1	--	--	--	--	--	--	0.0	0.0
Moose	33.9	24.0	37.6	145.39	25.2	18.92	20.0	28.7	43.4
Muskox	0.2	--	--	--	--	--	--	1.5	0.0
Small Land Mammals	**1.0**	**7.0**	**9.9**	**26.35**	**8.0**	**29.70**	**0.1**	**3.9**	**0.8**
Beaver	0.7	3.9	6.2	12.41	6.5	20.68	0.0	0.6	0.6
Coyote	0.0*	--	--	0.00	--	--	--	0.0	0.0
Foxes	0.0*	0.0*	0.0*	0.00	0.0	0.0*	0.0	0.0*	0.0
Hares	0.3	2.5	3.4	11.09	0.8	2.76	0.0	3.2	0.1
River otter	0.0*	0.13	0.0	0.47	0.1	0.28	0.1	<0.1	<0.1
Lynx	0.0*	0.11	<0.1	0.02	0.1	--	0.0	0.0	0.0
Marmot	0.0	0.0	0.0	0.00	0.0	--	0.0	0.0	0.0
Marten	0.0*	0.0*	0.0*	0.00	0.0*	--	0.0	0.0	0.0
Mink	0.0*	<0.1	0.0	0.06	<0.1	5.97	0.0	0.0	0.0
Muskrat	<0.1	<.1	0.1	0.30	0.2	0.14	0.0	0.0*	0.0*
Porcupine	<0.1	0.2	0.3	1.96	0.4	--	0.0	0.0*	<0.1

Table 3.21-9: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Nine Lower-Middle Kuskokwim Subregion Communities

Community	Bethel	Tuluksak	Akiak	Akiachak	Kwethluk	Nunapitchuk	Oscarville	Napakiak	Napaskiak
Reference Year	**2012**	**2010**	**2010**	**1998**	**2010**	**1983**	**2010**	**2011**	**2011**
Arctic ground squirrel	0.0	0.1	0.0	0.04	0.0	--	0.0	0.0	0.0
Weasel	0.0*	0.0*	0.0	0.00	0.0	--	0.0	0.0*	0.0
Wolf	0.0*	0.0*	0.0	0.00	0.0	--	0.0	0.0	0.0
Wolverine	0.0*	0.0	0.0	0.00	0.0	--	0.0	0.0	0.0
Fish	**99.4**	**260.5**	**500.7**	**897.39**	**254.6**	**653.38**	**425.2**	**382.9**	**279.4**
Salmon	68.8	173.0	292.0	649.15	170.3	288.01	256.0	232.2	174.5
Non-Salmon	30.7	87.5	208.7	248.24	84.3	365.38	169.2	150.7	104.9
Marine Invertebrates	**0.1**	**<0.01**	**0.2**	**0.00**	**<0.1**	**--**	**0.0**	**<0.1**	**0.0**
Birds and Eggs	**9.6**	**20.9**	**20.8**	**68.5**	**12.8**	**33.64**	**18.1**	**24.6**	**23.6**
Sandhill crane	0.3	0.5	0.43	6.97	0.4	2.51	1.6	3.0	1.9
Ducks	1.5	6.3	6.8	17.61	3.4	13.95	6.3	6.0	7.5
Geese	4.1	6.1	5.4	15.23	5.8	9.85	6.6	5.4	9.0
Swan	0.8	5.1	6.0	15.35	1.6	1.82	0.9	2.6	1.2
Ptarmigan and grouse	2.7	2.3	2.1	10.70	1.2	5.20	2.1	5.7	3.2
Birds Eggs	0.2	0.6	0.0	1.16	0.3	0.32	0.7	2.0	0.7
Vegetation	**8.7**	**30.6**	**21.2**	**60.82**	**15.9**	**44.19**	**21.5**	**18.6**	**16.0**

Notes:
Populations used in per capita harvest calculations – Bethel: 5,673; Tuluksak: 455; Akiak: 386; Akiachak: 523; Kwethluk: 713; Nunapitchuk: 457; Oscarville: 63; Napakiak: 316; Napaskiak: 480
* Small mammal species that were harvested, but are not typically eaten or were not reported as eaten. Harvest weight was not calculated for species harvested but not eaten.
Source: Brown et al. 2013; Ikuta et al. 2014; ADF&G 2015d; Runfola et al. 2017

3.21.5.3.1 BETHEL

Bethel lies on the northwest bank of the Kuskokwim River, 400 air miles from Anchorage. Runfola et al. (2017) estimated that Bethel's population in 2012 was 5,673. Bethel is the central service hub for the Yukon-Kuskokwim Delta, serving 56 remote villages with a regional population of 26,000 people. For this reason, Bethel is profiled in the EIS. In 2012, the average per capita harvest was 166 pounds of edible wild food or 572 pounds per household (Runfola et al. 2017). Between 2007 and 2011, the average annual per capita income was $29,261 (Fall 2013).

In 2013, Runfola et al. (2017), researchers from ADF&G, surveyed 466 of an estimated 1,645 eligible households in Bethel to determine subsistence harvests and uses of wild foods during 2012. This was the first comprehensive household survey conducted in Bethel, and unlike the other surveys cited in this EIS, the research was not funded by Donlin Gold. The final results were published in January 2017.

Species harvested and used: In 2012, almost all Bethel households (97 percent) used wild resources and 86 percent harvested or attempted to harvest resources. Surveyed households used an average of 15 kinds of resources and harvested an average of eight kinds of resources. Resources used by a majority of households included blueberry, moose, Chinook salmon, coho salmon, sockeye salmon, cloudberry, caribou, and chum salmon (see Table 3.21-10). The majority of households harvested salmon (52 percent) and non-salmon fish species (54 percent), while 30 percent harvested land mammals, 43 percent harvested birds and eggs, and 77 percent harvested vegetation such as berries and firewood (Runfola et al. 2017).

Table 3.21-10: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Bethel, 2012

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
All Resources	**96.8**	**85.2**	**70.2**	**92.3**
Salmon	**90.3**	**52.1**	**39.3**	**61.2**
Chinook	61.4	37.3	20.2	32.8
Chum	54.3	36.5	19.7	23.0
Coho	59.9	35.4	21.5	29.2
Sockeye	59.2	38.2	22.5	28.3
Pink	7.5	6.0	1.1	1.5
Non-Salmon Fishes	**75.8**	**53.6**	**37.1**	**60.3**
Humpback whitefish	32.2	18.2	9.7	16.7
Smelt	44.2	32.6	18.7	15.0
Burbot	26.8	17.4	8.2	12.9
Northern pike	28.3	21.0	10.1	9.7
Land Mammals	**80.7**	**30.0**	**33.9**	**70.0**
Black Bear	3.2	1.3	1.3	2.4

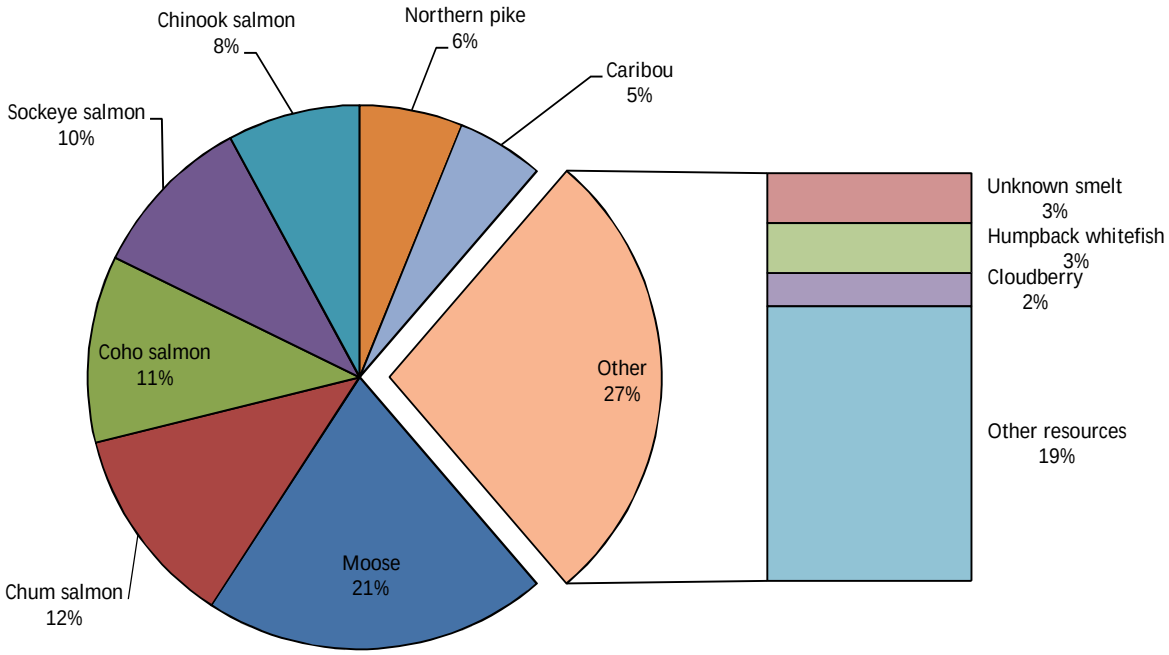
Table 3.21-10: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Bethel, 2012

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Caribou	55.1	13.1	15.1	44.7
Moose	74.5	18.7	27.5	59.9
Beaver	9.4	6.4	3.2	3.4
Snowshoe hare	11.8	9.0	3.7	2.8
Red fox	3.6	3.6	0.6	0.4
Marine Mammals	**44.8**	**3.9**	**11.6**	**44.2**
Bearded seal	10.5	1.1	2.8	9.7
Ringed seal	8.8	2.1	3.2	7.3
Unknown seals	35.3	0.4	6.9	34.8
Walrus	14.2	0.6	3.9	13.8
Birds and Eggs	**62.4**	**42.9**	**31.1**	**39.3**
Ducks	37.6	23.4	11.8	18.7
Geese	48.1	27.9	16.7	27.7
Ptarmigan	42.3	29.0	18.3	16.1
Eggs	19.1	7.3	4.3	12.7
Vegetation	**84.3**	**77.0**	**33.0**	**40.1**
Berries	80.3	71.0	25.1	27.5
Plants/greens/mushrooms	44.6	38.2	14.8	20.8
Wood	28.1	24.9	4.1	5.4

Notes:
Data based on surveys of 466 of an estimated 1,645 eligible households in Bethel
Source: Runfola et al. 2017

In 2012, salmon made up 41 percent of the total subsistence harvest by edible weight. Chum, sockeye, coho, and Chinook salmon were among the top five species harvested in Bethel by edible weight, making up 12, 11, 10, and 8 percent of the harvest, respectively. At 21 percent of the edible harvest, moose was the top species harvested in 2012. Northern pike, caribou, unknown smelt, humpback whitefish, and cloudberry rounded out the top ten subsistence resources by edible weight in 2012 (Runfola et al. 2017) (Figure 3.21-25). Chinook salmon in the Kuskokwim River were unusually low in 2012 due to regulatory closures caused by poor returns so that data on total harvests collected in 2012 may not be representative compared to years where there were no restrictions.

Figure 3.21-25: Composition of Bethel Subsistence Harvest by Estimated Edible Weight, 2012



Source: Runfola et al. 2017

Harvest areas: Runfola et al. (2017) estimated that surveyed households used 17,786 square miles for subsistence activities in 2012. Bethel hunters searched for and harvested moose in a large area of the Y-K Delta (Figure 3.21-26). Hunters searched for caribou in the Eek Lake area and in the area between the Eek and Kwethluk rivers. Most subsistence salmon fishing takes place in the main stem of the Kuskokwim River from the mouth of the river to a point near Akiak (Figure 3.21-27). Bethel residents harvest marine mammals in the lower Kuskokwim River, Kuskokwim Bay, and in several areas of the Bering Sea from Goodnews Bay to the mouth of the Yukon River (Figure 3.21-28).

Sharing: In 2012, 92 percent of Bethel households received gifts of wild resources, and 70 percent gave resources away. On average, Bethel households received seven kinds of wild foods and gave away four different kinds (Runfola et al. 2017). Bethel residents share food with other households in the community and with households in other communities in the Y-K region and beyond. For a display of Bethel sharing networks, see Figure 3.21-29.

Concerns: In 2013, Bethel residents provided their views on the importance of subsistence resources for their community and way of life. One resident referred to the economic importance of subsistence foods as,

> "We have to count on our subsistence resources... Because of the cost of existing out here, you depend on the fish, and the birds, and the berries and the greens and the big game" (quoted in Fall 2013).

Several others talked about the spiritual aspects of subsistence:

> [Subsistence is] wholeness... mind, body, sprit...You are what you eat (quoted in Fall 2013).
>
> You know there are people in Bethel who genuinely need subsistence fish. That part of their spiritual, part of their cultural upbringing are genuinely attached to it (quoted in Fall 2013).
>
> [What subsistence means] is health, community... like a loose way to find spirituality... staying active, and then the nutrition that all the wild foods provide (quoted in Fall 2013).
>
> It [subsistence] means the connection to the ancestry... It makes them feel good to be able to work on the animals and eat the animals and berries and whatever, just like their ancestors did (quoted in Fall 2013).

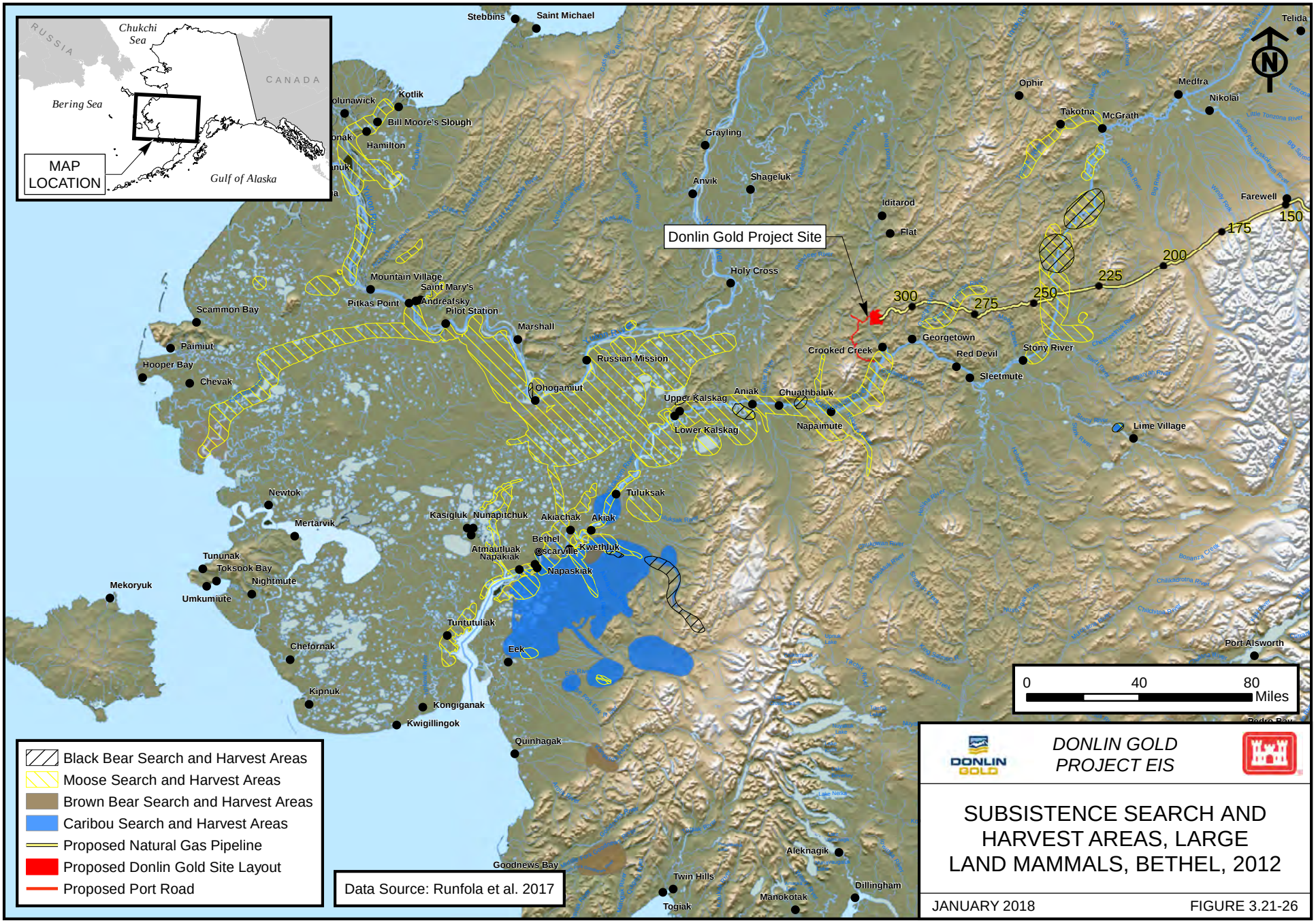
3.21.5.3.2 KWETHLUK

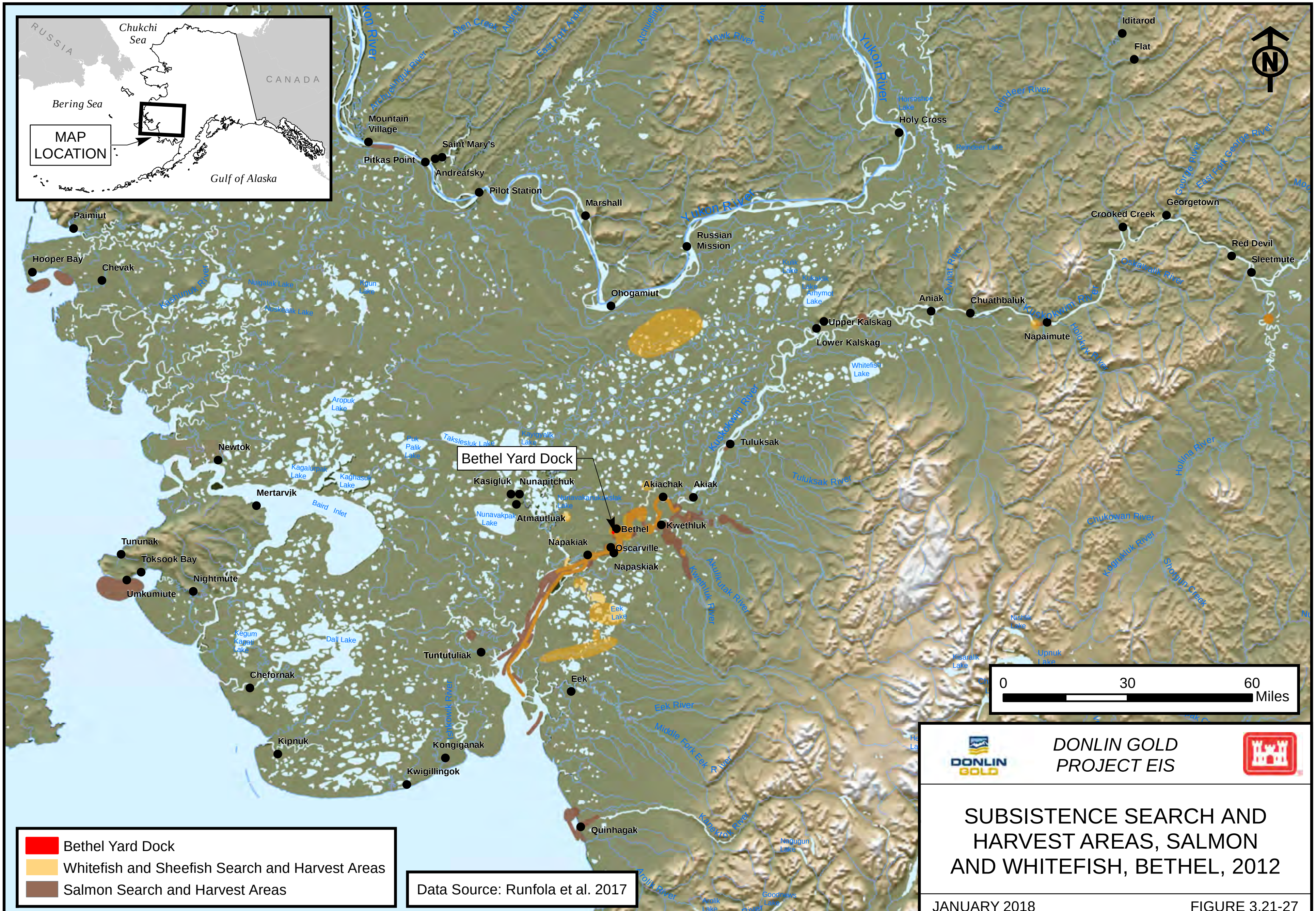
Kwethluk is a Yup'ik community located 12 air miles east of Bethel on the Kwethluk River at the junction with the Kuskokuak Slough off the Kuskokwim River. It is the second largest community along the Lower Kuskokwim River. The community is strategically located on the lower Kuskokwim River and has experienced rapid, but sporadic population growth since the 19th century. Brown et al. (2013) estimated that Kwethluk had a population of 713 in 2010.

In April of 2011, researchers surveyed 93 of 155 households regarding harvests in 2010. Expanding for the 62 unsurveyed households, Kwethluk households reported a harvest of 259,699 pounds of wild food or an average per household harvest of 1,676 pounds (Brown et al. 2013). Household incomes in Kwethluk averaged $34,250 (Brown et al. 2013).

Species Harvested and Used: In 2010, Chinook, chum, and sockeye salmon; humpback whitefish; and northern pike composed 59 percent of the total Kwethluk subsistence harvest (Figure 3.21-30). The remaining 41 percent was comprised of large land mammals, other fish species, marine mammals, various edible plants, birds and eggs, and marine invertebrates. Chinook salmon made up 42 percent of the total salmon harvest. Sockeye salmon were the next most frequently harvested (22 percent), followed by chum, and coho salmon. While the subsistence fishery is focused on Chinook salmon, some residents noted that elders preferred chum salmon, which are not as rich (Brown et al. 2013). Humpback whitefish made up 42 percent of the non-salmon fish species harvest. Kwethluk residents also reported harvesting smelt, burbot, sheefish, broad whitefish, and northern pike. Some salmon for home use are also taken out of commercial fish harvests (Brown et al. 2013).

By resource category, the most widely used resources were fish and land mammals (each used by 98 percent of households), vegetation (95 percent), birds and eggs (91 percent), and marine mammals (62 percent). The most widely harvested resource categories were vegetation, fish, birds and eggs, and land mammals. Referring to subsistence resource species, Chinook salmon were most widely used (95 percent of households), while caribou, moose, ducks, and berries were each used by over 80 percent of households. Together, moose and caribou composed 13 percent of the total harvest but were used by 84 percent and 87 percent of households, respectively (Table 3.21-11).


MAP LOCATION
Chukchi Sea
Bering Sea
Gulf of Alaska
RUSSIA
CANADA
Donlin Gold Project Site
Stebbins
Saint Michael
Kotlik
Bill Moore's Slough
Hamilton
Grayling
Anvik
Shageluk
Iditarod
Flat
Holy Cross
Ophir
Medfra
Nikolai
Takotna
McGrath
Telida
Farewell
150
175
200
225
250
275
300
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Scammon Bay
Paimiut
Hooper Bay
Chevak
Marshall
Russian Mission
Ohogamiut
Crooked Creek
Georgetown
Red Devil
Stony River
Sleetmute
Aniak
Chuathbaluk
Upper Kalskag
Lower Kalskag
Napaimute
Lime Village
Newtok
Mertarvik
Tuluksak
Kasigluk
Nunapitchuk
Akiachak
Akiak
Bethel
Atmautluak
Napakiak
Kwethluk
Napaskiak
Tununak
Toksook Bay
Nightmute
Umkumiute
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Goodnews Bay
Twin Hills
Togiak
Manokotak
Aleknagik
Dillingham
Port Alsworth
0
40
80
Miles
Black Bear Search and Harvest Areas
Moose Search and Harvest Areas
Brown Bear Search and Harvest Areas
Caribou Search and Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Data Source: Runfola et al. 2017
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, LARGE LAND MAMMALS, BETHEL, 2012
JANUARY 2018
FIGURE 3.21-26



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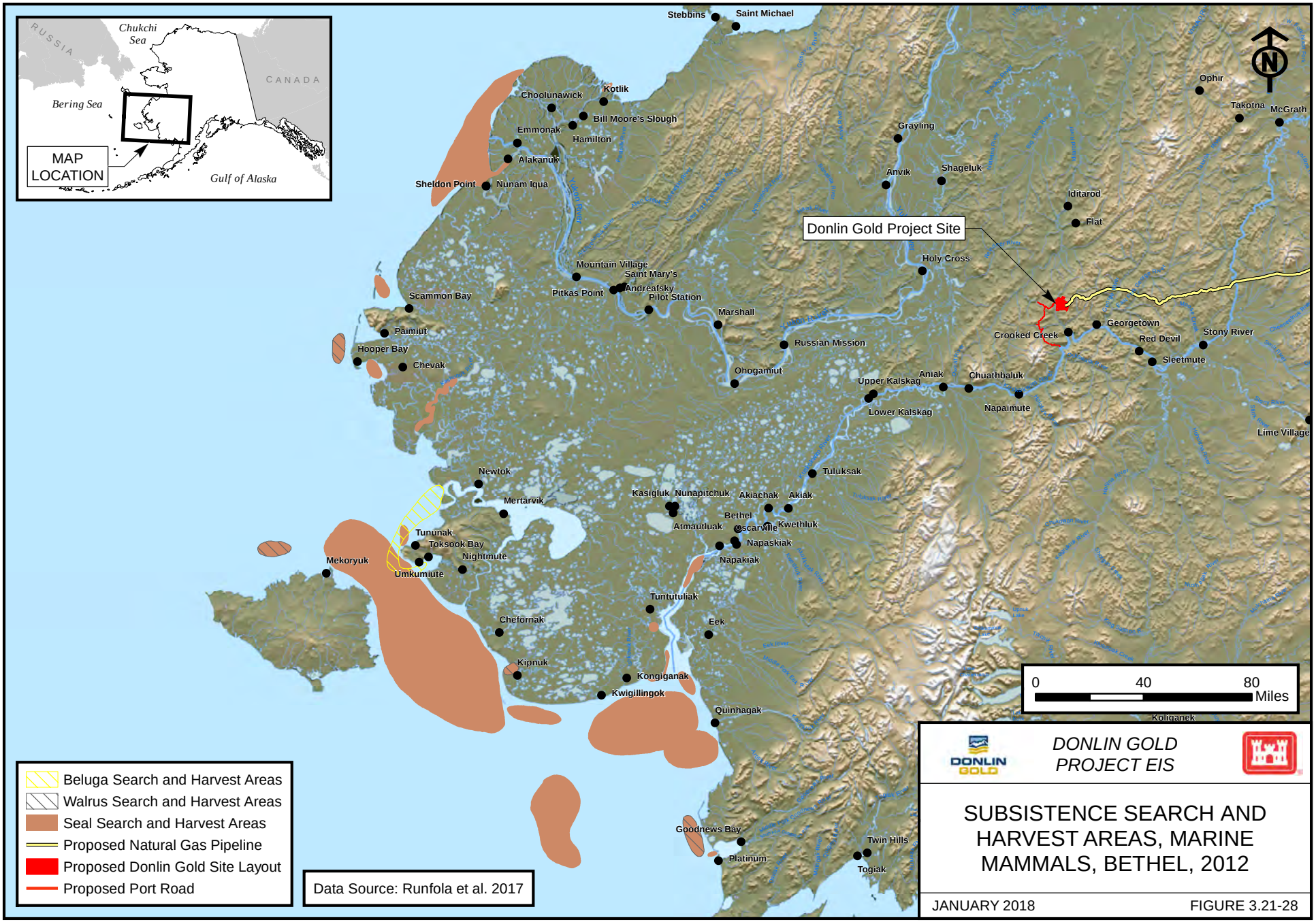
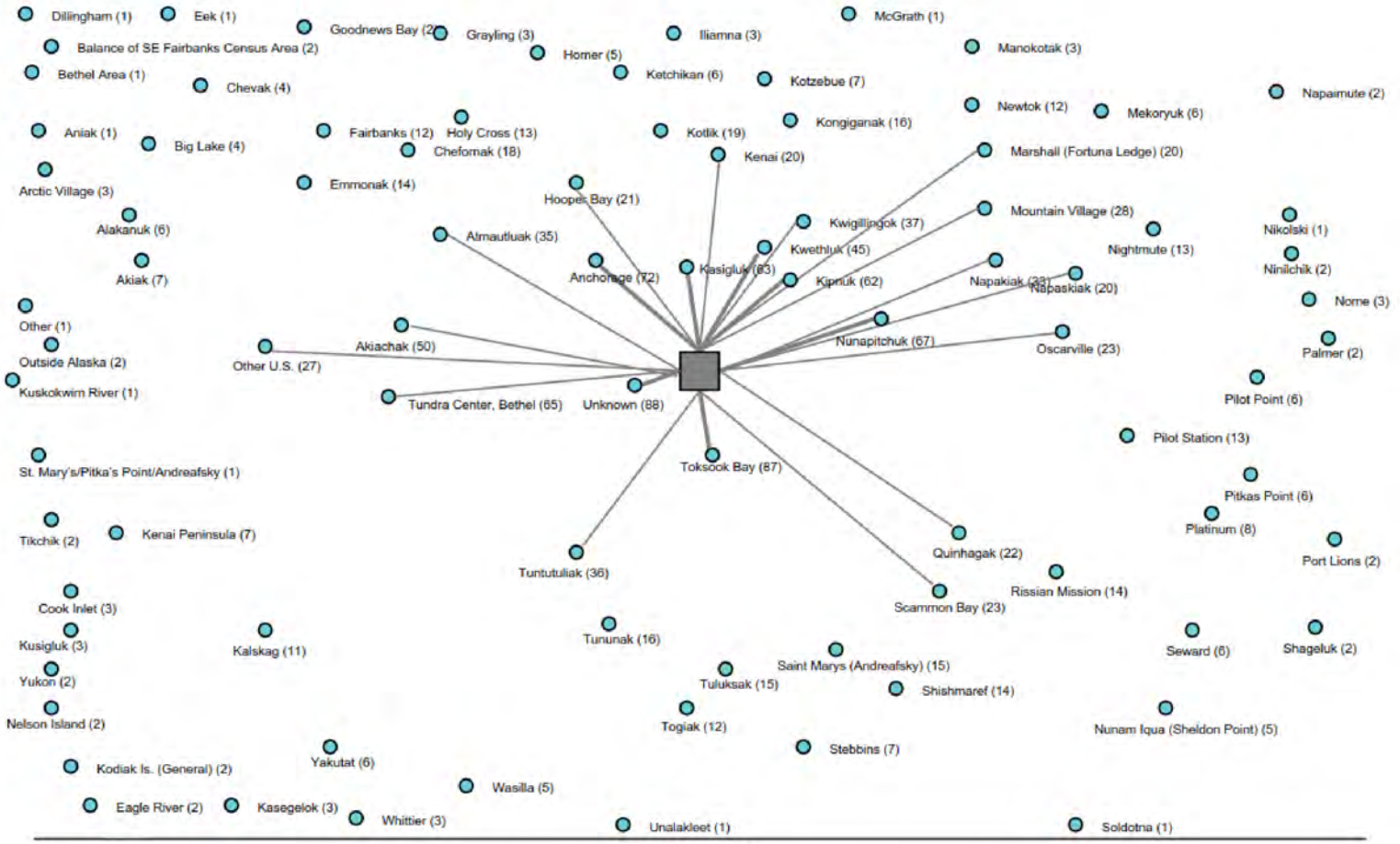
SUBSISTENCE SEARCH AND HARVEST AREAS, SALMON AND WHITEFISH, BETHEL, 2012

JANUARY 2018

FIGURE 3.21-27


MAP LOCATION
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
Donlin Gold Project Site
Stebbins
Saint Michael
Choolunawick
Kotlik
Bill Moore's Slough
Emmonak
Hamilton
Alakanuk
Sheldon Point
Nunam Iqua
Grayling
Anvik
Shageluk
Ophir
Takotna
McGrath
Iditarod
Flat
Holy Cross
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Scammon Bay
Marshall
Paimiut
Hooper Bay
Chevak
Russian Mission
Ohogamiut
Crooked Creek
Georgetown
Red Devil
Stony River
Sleetmute
Upper Kalskag
Aniak
Chuathbaluk
Napaimute
Lower Kalskag
Lime Village
Newtok
Mertarvik
Tuluksak
Kasigluk
Nunapitchuk
Akiachak
Akiak
Bethel
Atmautluak
Oscarville
Kwethluk
Napaskiak
Napakiak
Tununak
Toksook Bay
Nightmute
Umkumiute
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Koliganek
Goodnews Bay
Platinum
Twin Hills
Togiak
0
40
80
Miles
Beluga Search and Harvest Areas
Walrus Search and Harvest Areas
Seal Search and Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Data Source: Runfola et al. 2017
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, MARINE MAMMALS, BETHEL, 2012
JANUARY 2018
FIGURE 3.21-28



LEGEND

Exchange of wild foods from source harvesting and processing households to other households/communities, as reported by surveyed households.

Bethel households

Households in other community

LINES are scaled by the number of sharing events between surveyed households and other households.
Total number of sharing events in parentheses. Total number of sharing events between Bethel households, N=1561.

Data Source: Runfola et al. 2017

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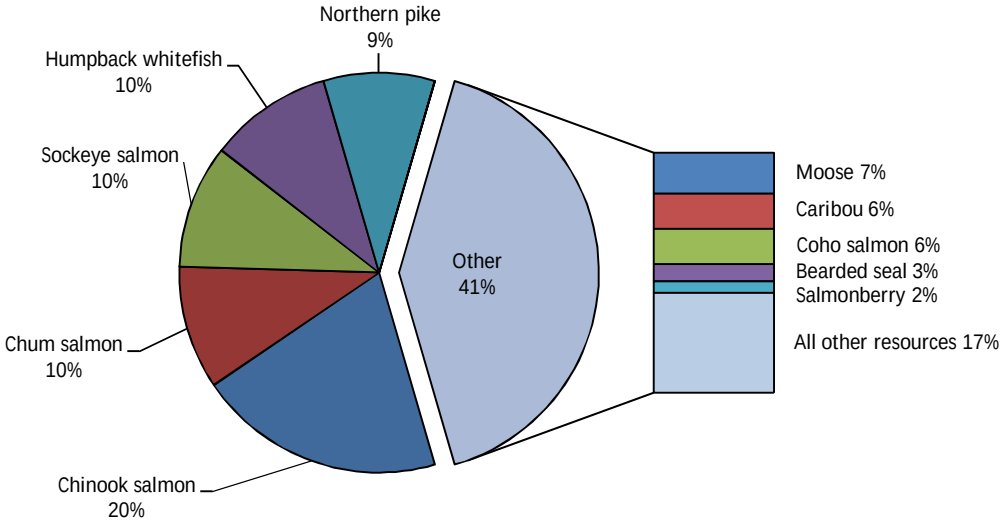
WILD FOOD HARVESTING AND PROCESSING NETWORK, BETHEL, 2012

JULY 2017

FIGURE 3.21-29

Figure 3.21-30: Composition of Kwethluk Subsistence Harvest by Estimated Edible Weight, 2010



Source: Brown et al. 2013

The importance of subsistence in Kwethluk is reflected in the high harvest and use levels; every household in Kwethluk used a subsistence resource and 97 percent of households harvested at least one resource. The most widely harvested resource was vegetation (94 percent of households). Harvest rates were also high for non-salmon fish species (75 percent of households) and salmon (70 percent) (Brown et al. 2013).

Table 3.21-11: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Kwethluk, 2010

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Salmon				
Chinook	95	66	43	51
Chum	72	52	34	35
Coho	57	41	24	30
Sockeye	67	49	31	28
Pink	13	11	2	5
Unknown salmon	0	0	0	0
Non-Salmon Fishes				
Humpback whitefish	74	47	16	41
Broad whitefish	43	28	13	25
Sheefish	26	16	8	12
Smelt	25	17	5	9
Land Mammals				

Table 3.21-11: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Kwethluk, 2010

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Black Bear	16	5	6	12
Caribou	87	39	32	65
Moose	84	22	22	67
Beaver	48	32	14	25
Hares	26	17	9	10
Muskrat	12	8	5	6
Marine Mammals				
Seals	60	13	13	52
Birds				
Ducks	84	58	35	37
Geese	78	56	28	37
Upland birds	28	23	12	8
Bird eggs	17	9	6	11
Vegetation				
Berries	88	83	37	32
Plants/greens/mushrooms	70	63	22	22
Wood	66	57	12	15

Notes:
Data based on surveys of 93 of 155 households in Kwethluk
Source: Brown et al. 2013.

Harvest Areas: In 2010, Kwethluk residents reported using a total of 6,379 square miles for subsistence, representing diverse marine, tundra, and boreal forest environment (Figure 3.21-31). Kwethluk hunters ranged further for large land mammals than any other resource. Moose hunters traveled up the Kisaralik, Akulikutak, and Kwethluk river drainages for a 10-day registration hunt in September. Some hunters also traveled up the Kuskokwim into GMU 19A and the Lower Yukon River to hunt for moose in December.

While Kwethluk residents traveled widely to harvest subsistence resources, the area that experienced the most concentrated use was a 40-mile radius of land southeast of the community encompassing the Kisaralik, Akulikutak, and Kwethluk tributaries of the Kuskokwim River. Access was by boat and then over land on foot or snowmachine in the winter (Brown et al. 2013). Salmon fishing and the harvest of non-salmon fish species was concentrated along the Kuskokuak Slough and the Kwethluk and Kuskokwim rivers, but families also reported harvesting salmon near the communities of Napaskiak, Tuntutuliak, and Quinhagak (Figure 3.21-32).

Sharing: In most rural communities, certain households specialized in the harvest of wild foods. In Kwethluk, 27 percent of the households harvested 70 percent of the wild foods. As in

other rural communities the highest harvesting households conformed to a certain pattern; in Kwethluk the highest harvesting household was headed by a single male, who reported harvesting 11,514 pounds of wild food, while the second highest harvesting household was composed of a mature couple in their late 50s who reported a harvest of 11,396 pounds of wild food (Brown et al. 2013). The food harvested by this relatively small number of households was redistributed through sharing networks based on kinship or other social relationships (Figure 3.21-33).

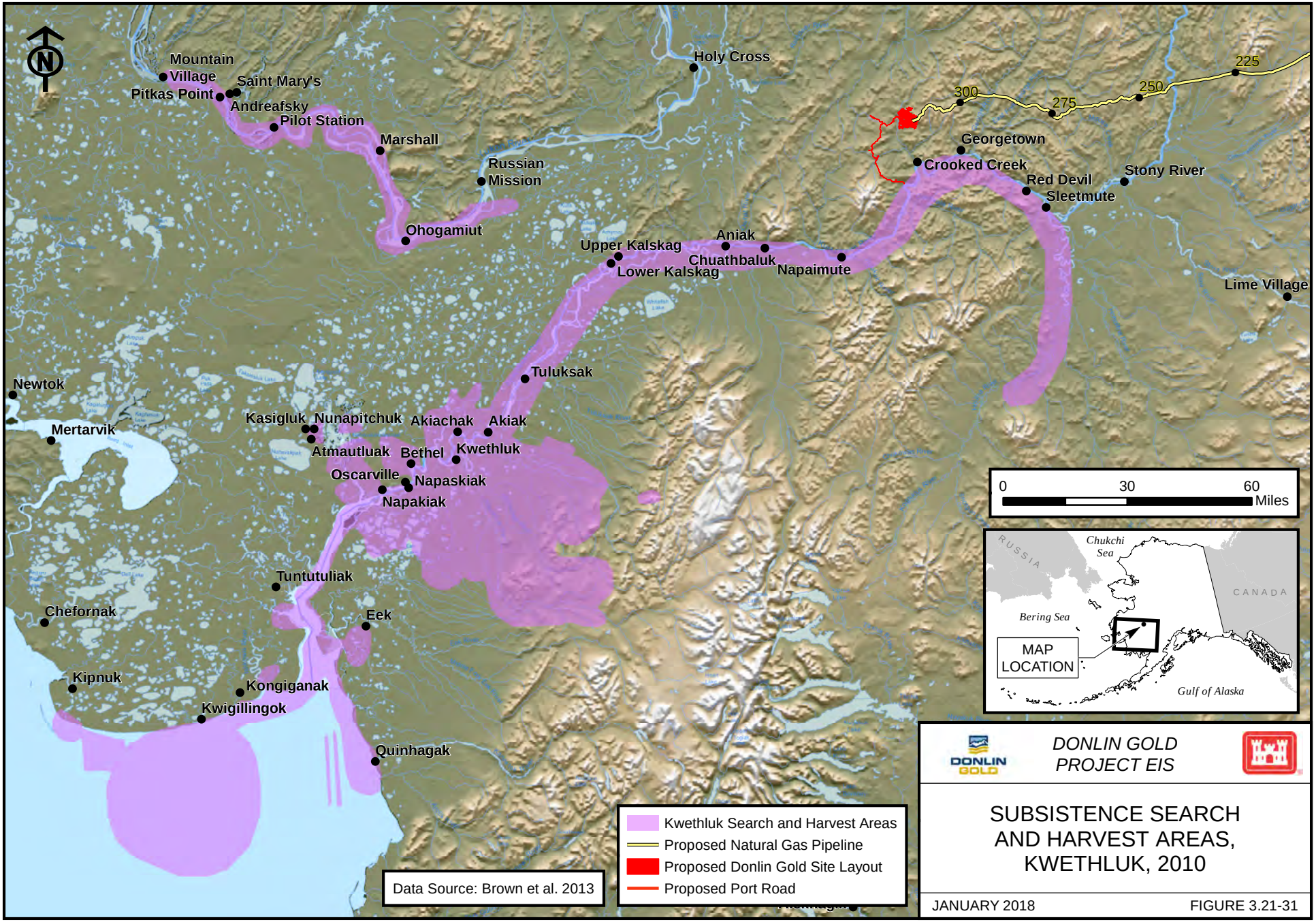
Variability: For all resource categories, a majority of households in Kwethluk said they got enough subsistence resources in 2010 (Brown et al. 2013). When comparing use of wild resources against previous years, more than half the households said they used less salmon. Of households reporting less use of salmon, 21 percent said it was because of low abundance and another 20 percent said poor weather or changes in the environment prevented them from meeting their needs. Forty-five percent of households said they did not get enough salmon, particularly Chinook salmon; this despite the fact that the 2010 harvest of 5,458 fish was just below the 10-year average (2000 and 2010) of 5,892 fish (Brown et al. 2013).

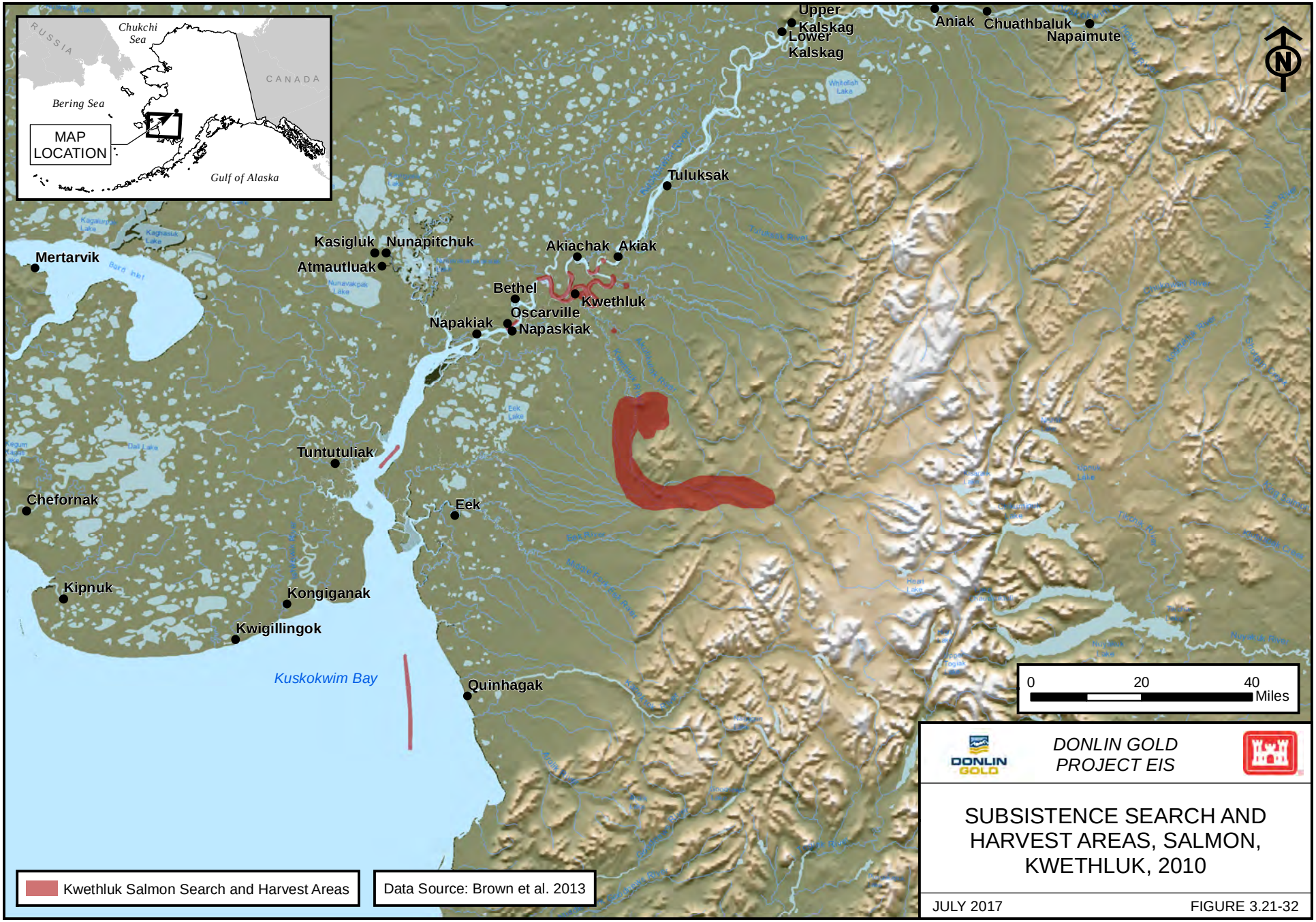
Even though Kwethluk fishers exceeded their average in 2010, change in salmon abundance and harvest effort was a consistent theme among Kwethluk fishers. Ten years was not considered an adequate time period in which to measure population trends; and entire lifetime was the generally preferred frame of reference. The consensus was that over their lifetime annual variations in salmon populations had occurred though abundance has generally declined. One point about variability in salmon harvests: while Chinook runs have declined over time the harvest data shows a greater variation in harvest among salmon that come later in the year. This is because people concentrate their harvest at the beginning of the season when the Chinook run (Brown et al. 2013).

According to most Kwethluk households they used about the same amount of land mammals and marine mammals as in previous years and majorities in both cases said they got enough of those resources. Those households reporting that they did not get enough land mammals gave various reasons but the most frequent was the high price of gasoline; many also mentioned competition in the area and the short hunting season. The primary reason given by households for not getting enough marine mammals was because they did not receive enough from other harvesters (Brown et al. 2013).

Kwethluk's estimated moose harvest in 2010 was 33 moose, equal to the number of moose reported harvested in 1986. This does not mean that the moose population or hunting efforts have been steady. In 2010, Kwethluk residents agreed that moose numbers were increasing (in GMU 18) so their concerns were with restrictions, particularly the length of the season.

Almost 60 percent of Kwethluk households said they get enough non-salmon fish species, but just about half of the households said they used less than in previous years. Reasons given for getting few non-salmon fish species included not having the equipment or they did not receive fish as usual. Compared to 1986, when the last harvest survey was done, harvests of certain non-salmon fish species have declined drastically, while others have remained steady. Northern pike harvests have declined from 40,694 pounds in 1986 to 24,125 pounds in 2010. Likewise, burbot harvests have declined from 33,735 pounds to 1,938 pounds. Whitefish harvests, on the other hand, seem to be stable at about 30,000 pounds. While Arctic grayling, trout, and other non-salmon species are harvested in far fewer numbers, they have considerable cultural importance (Brown et al. 2013).


Mountain Village
Saint Mary's
Pitkas Point
Andreafsky
Pilot Station
Marshall
Holy Cross
Russian Mission
Ohogamiut
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Georgetown
Crooked Creek
Red Devil
Sleetmute
Stony River
Lime Village
225
250
275
300
Newtok
Mertarvik
Kasigluk
Nunapitchuk
Akiachak
Akiak
Tuluksak
Atmautluak
Bethel
Kwethluk
Oscarville
Napaskiak
Napakiak
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
0
30
60
Miles
RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
Kwethluk Search and Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Data Source: Brown et al. 2013
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, KWETHLUK, 2010
JANUARY 2018
FIGURE 3.21-31

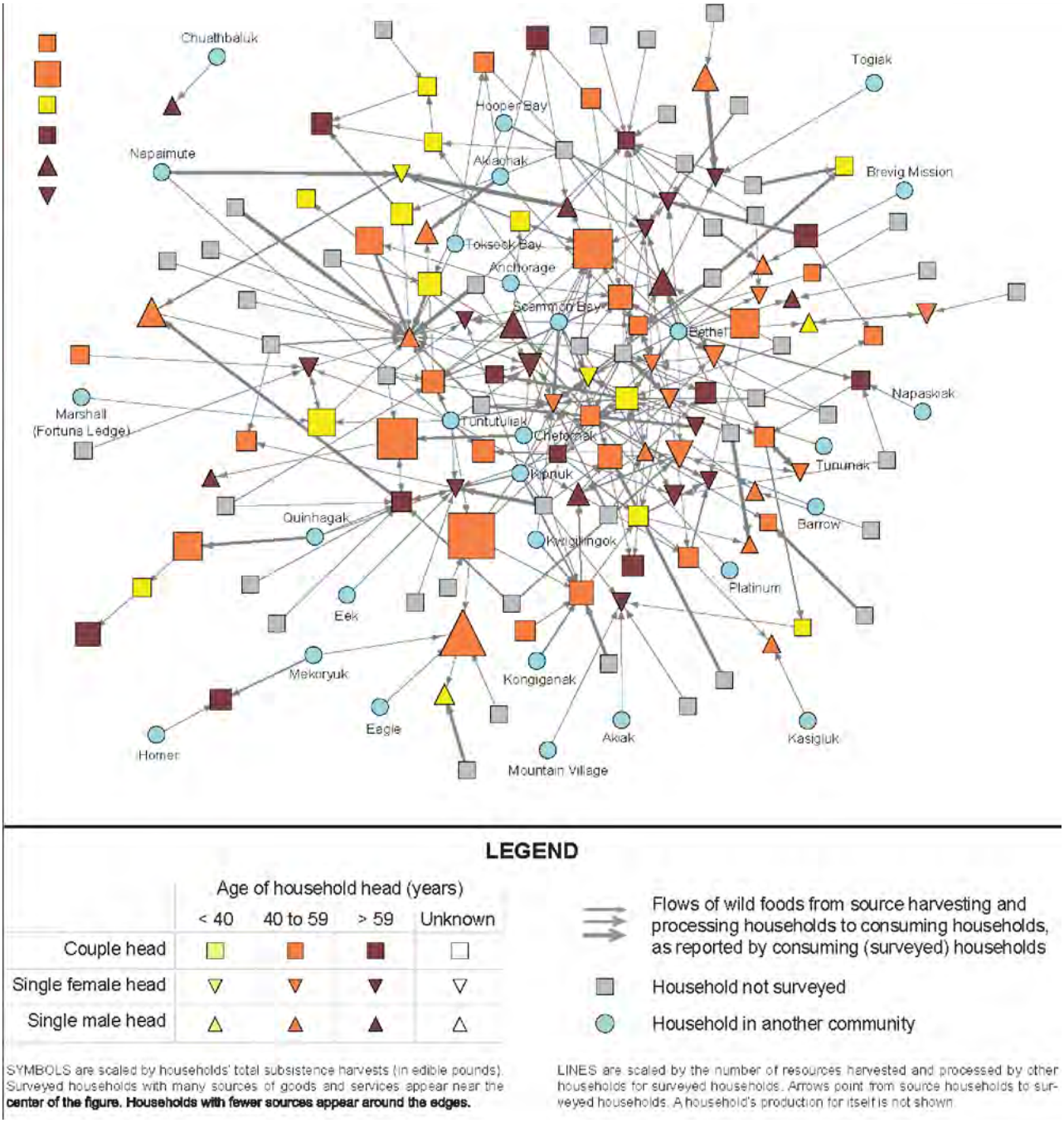


DONLIN GOLD PROJECT EIS

SUBSISTENCE SEARCH AND HARVEST AREAS, SALMON, KWETHLUK, 2010

JULY 2017

FIGURE 3.21-32



Data Source: Brown et al. 2013

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, KWETHLUK, 2010

JULY 2017

FIGURE 3.21-33

3.21.5.4 SUBSISTENCE HARVEST PATTERNS: LOWER KUSKOKWIM SUBREGION

Lower Kuskokwim subregion communities include Tuntutuliak, Eek, Kongiganak, Kwigillingok, and the coastal communities of Quinhagak, Goodnews Bay, and Platinum. No comprehensive subsistence harvest data are available for the communities of Kongiganak, Kwigillingok, Goodnews Bay, and Platinum. In 2014, Ikuta et al. (2016) conducted comprehensive harvest surveys in the Yup'ik communities of Eek, Tuntutuliak, and Quinhagak. Table 3.21-12 provides information on per capita harvests in these three communities. Quinhagak was selected as the example community for this subregion.

Table 3.21-12: Per Capita Subsistence Harvests in Edible Weight (lbs.) for Three Lower Kuskokwim Subregion Communities, 2013

	Tuntutuliak	Eek	Quinhagak
All Resources	**361.0**	**244.1**	**294.7**
Marine Mammals	**51.2**	**18.7**	**30.4**
Seals	42.5	12.5	20.0
Walrus	8.7	6.2	6.2
Whales	0.0	0.0	4.1
Large Land Mammals	**26.2**	**39.3**	**52.8**
Bears	0.0	0.0	0.0
Caribou	3.9	17.5	22.2
Dall sheep	0.0	0.0	0.0
Moose	22.3	21.9	30.7
Muskox	0.0	0.0	0.0
Small Land Mammals	**1.3**	**0.9**	**2.3**
Beaver	0.5	0.5	1.8
Coyote	0.0	0.0	0.0
Red fox	0.0	0.0	0.0*
Hares	0.4	0.3	0.2
River otter	0.3	<0.1	0.1
Lynx	<0.1	0.0*	<0.1
Marten	0.0	0.0	0.0
Mink	<0.1	0.0*	0.0*
Muskrat	0.1	0.0*	<0.1
Porcupine	<0.1	0.1	0.1
Arctic ground squirrel	0.0	0.0	<0.1
Wolf	0.0	0.0	0.0*
Wolverine	0.0	0.0*	0.0*

Table 3.21-12: Per Capita Subsistence Harvests in Edible Weight (lbs.) for Three Lower Kuskokwim Subregion Communities, 2013

	Tuntutuliak	Eek	Quinhagak
Fishes	**235.7**	**132.2**	**148.0**
Salmon	137.9	71.5	102.8
Non-salmon	97.8	60.7	45.1
Marine Invertebrates	**0.0**	**0.1**	**0.4**
Birds and eggs	**18.4**	**32.5**	**30.5**
Sandhill crane	2.9	3.4	2.2
Ducks	1.9	4.9	3.2
Geese	8.3	14.0	13.8
Shorebirds	0.0	0.0	0.0
Tundra swan	1.6	4.4	4.2
Ptarmigan	2.6	4.2	3.5
Bird eggs	1.2	1.5	3.4
Vegetation	**28.0**	**20.3**	**30.3**

Notes:
Populations used in per capita harvest calculations – Tuntutuliak: 412.9; Eek: 347.3; Quinhagak: 732.7
* Small mammal species that were harvested, but are not typically eaten. Harvest weight was not calculated for species harvested but not eaten.

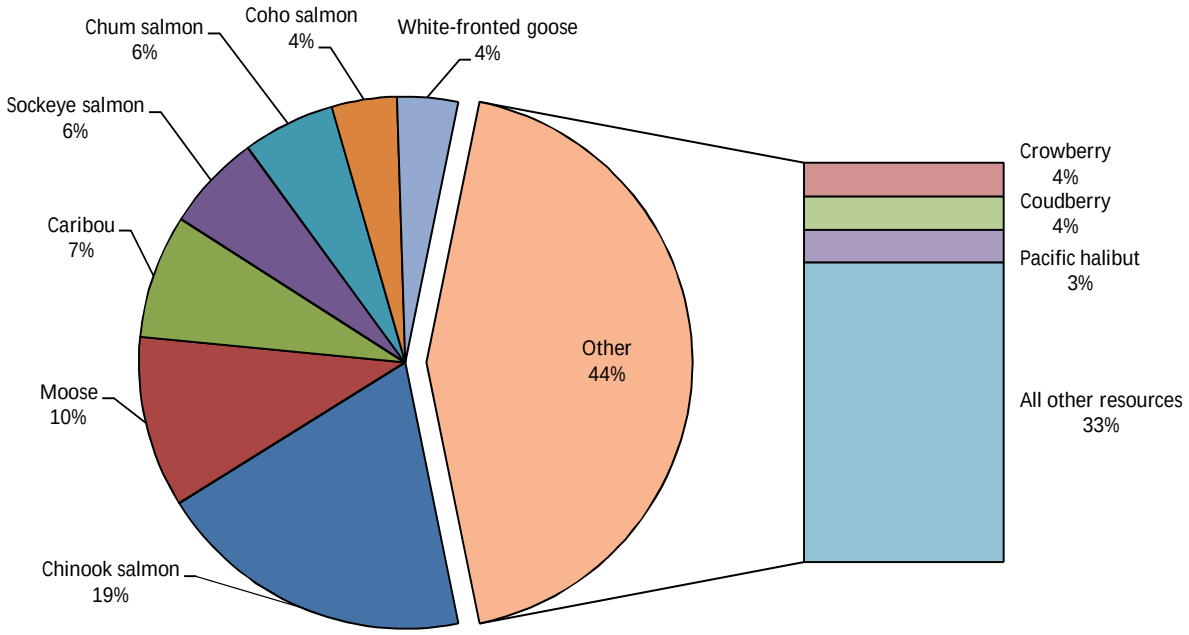
Source: Ikuta et al. 2016

3.21.5.4.1 QUINHAGAK

Quinhagak is on the Kanektok River on the east shore of Kuskokwim Bay, less than a mile from the Bering Sea coast. It lies 71 miles southwest of Bethel. The city was incorporated in 1975. Ikuta et al. (2016) estimated Quinhagak's population to be 733 in 2013. The most recent survey of subsistence harvests for this community was conducted in 2014. Researchers conducted interviews in 109 of 162 households in Quinhagak to determine subsistence harvests and uses of wild foods for the 2013 calendar year (Ikuta et al. 2016). The study estimated a total of 215,950 edible pounds of wild food were harvested in 2013, or 295 pounds per capita.

Species Harvested and Used: The study found that salmon made up a large portion of the wild food harvest in Quinhagak in 2013, contributing 35 percent of the total edible weight. Chinook, sockeye, chum, and coho salmon were among the top ten harvested species by edible weight, accounting for 19 percent, 6 percent, 6 percent, and 4 percent of the harvest, respectively. Large land mammals were also important subsistence resources in Quinhagak during 2013. Moose made up 10 percent of the harvest by edible weight and caribou were 7 percent. White-fronted goose (4 percent of the harvest), crowberry (4 percent), cloudberry (4 percent), and Pacific halibut (3 percent) rounded out the top ten subsistence species by edible weight (Figure 3.21-34) (Ikuta et al. 2016).

Figure 3.21-34: Composition of Quinhagak Subsistence Harvest by Estimated Edible Weight, 2013



Source: Ikuta et al. 2016

In 2013, households harvested an average of 17 different resources and used an average of 25 resources. All households used at least one resource and virtually all (98 percent) harvested at least one resource. During the study year, 87 percent of Quinhagak households reported using Chinook salmon. Almost 83 percent of households used large land mammals such as caribou and moose. Ninety-five percent of households used vegetation and 93 percent used birds and eggs. Some of the most widely harvested resources included cloudberry (85 percent of households), crowberry (74 percent), nangoonberry (63 percent), and Chinook salmon (63 percent) (Table 3.21-13).

Table 3.21-13: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Quinhagak, 2013

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
All Resources	**100.0**	**98.2**	**78.0**	**94.5**
Salmon	**94.5**	**71.6**	**49.5**	**49.5**
Chinook	87.2	63.3	40.4	44.0
Chum	69.7	49.5	29.4	30.3
Coho	71.6	52.3	23.9	22.0
Sockeye	77.1	53.2	29.4	31.2
Pink	11.0	6.4	3.7	6.4
Unknown salmon	0.0	0.0	0.0	0.0
Non-Salmon Fishes	**93.6**	**82.6**	**46.8**	**81.7**

Table 3.21-13: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Quinhagak, 2013

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Pacific halibut	68.8	15.6	6.4	60.6
Bering cisco	35.8	27.5	11.9	13.8
Smelt	72.5	59.6	24.8	20.2
Dolly Varden	61.5	51.4	22.9	22.0
Large Land Mammals	**82.6**	**35.8**	**31.2**	**65.1**
Caribou	65.1	29.4	23.1	43.1
Moose	70.4	19.3	20.4	52.3
Small Land Mammals	**29.4**	**23.9**	**10.1**	**7.3**
Beaver	18.3	11.9	7.3	5.5
Snowshoe hare	8.3	5.5	1.8	2.8
Small Alaska hare	6.4	4.6	0.0	0.9
Porcupine	7.3	6.4	1.8	0.9
Marine Mammals	**77.1**	**33.0**	**25.7**	**59.6**
Spotted seal	45.9	24.8	15.6	22.9
Ringed seal	25.0	12.8	8.3	13.0
Walrus	19.3	2.8	4.6	15.6
Beluga whale	17.4	4.6	3.7	13.8
Marine Invertebrates	**12.8**	**6.4**	**3.7**	**8.3**
Birds and Eggs	**92.7**	**78.0**	**46.8**	**49.5**
Mallard	36.7	28.4	8.4	10.2
White-fronted goose	69.7	56.0	18.3	18.3
Ptarmigan	71.6	52.3	24.1	25.0
Gull eggs	27.5	23.9	8.3	3.7
Vegetation	**95.4**	**89.9**	**51.4**	**48.6**
Cloudberry	90.8	85.3	30.8	13.9
Crowberry	85.3	74.3	28.0	22.9
Nangoonberry	67.9	63.3	6.4	13.9
Wood	61.5	57.8	12.8	12.8

Notes:
Data based on surveys of 109 of 162 households in Quinhagak

Source: Ikuta et al. 2016

Seasonal Round: Beginning in April, large quantities of char, round whitefish, grayling, and rainbow trout were harvested with nets in the ice-free sections of the Kanektok River (Wolfe et al. 1984). Late May marks the arrival of salmon. In late summer and early fall, coho salmon, along with char, grayling, round whitefish, and rainbow trout are harvested from the Kanektok River. In late winter and spring, large schools of smelt appear in the lower reaches of the Kanektok River. Toward the end of April migratory waterfowl arrive and hunters begin to harvest them (Figure 3.21-35), sometimes in conjunction with seal hunting.

Harvest Areas: Survey respondents reported using a combined 8,495 square miles for subsistence search and harvest areas in 2013. The subsistence search and harvest area used by Quinhagak residents for all resources is shown in Figure 3.21-36. Residents traveled extensively in the Y-K Delta region, including Kuskokwim Bay, Goodnews Bay, Hooper Bay, area around the lower Yukon and Kuskokwim rivers, and the Kanektok, Arolik, Goodnews, and Kwethluk rivers (Ikuta et al. 2016).

In 1982, eight families were reported to travel to spring camps in mountain valleys above the Kanektok, Arolik, and Jacksmith rivers to hunt parka squirrels. Historically, parka squirrel skins were an important trade item and in 1982 squirrel skin parkas were a valuable prestige item.

In September and October, moose, brown bear, squirrel, and beaver are hunted up the Kanektok and Eek rivers. Moose were said to be abundant in the Kanektok River drainage and common along the Eek River. Both caribou and moose were hunted in the winter after freezeup. Brown bear are also taken, and some older residents considered the fat a favorite food.

Sharing: In 2013, a majority of Quinhagak households (78 percent) gave away subsistence resources and almost all (95 percent) received subsistence resources. Households gave away an average of seven different resources and received an average of nine different resources. Quinhagak residents received food from other households in the community and with households in other Alaska communities, particularly those in the Y-K region. For a display of the flow of wild foods into Quinhagak households, see Figure 3.21-37. In total, surveyed households reported receiving food from 32 other communities around the state. Nearly every surveyed household (98 percent) in Quinhagak received subsistence resources in 2013.

Variability: No quantitative or interview information is available to characterize variability in subsistence harvest patterns over time for this community.

Figure 3.21-35: Quinhagak Seasonal Round of Subsistence Harvests 1983

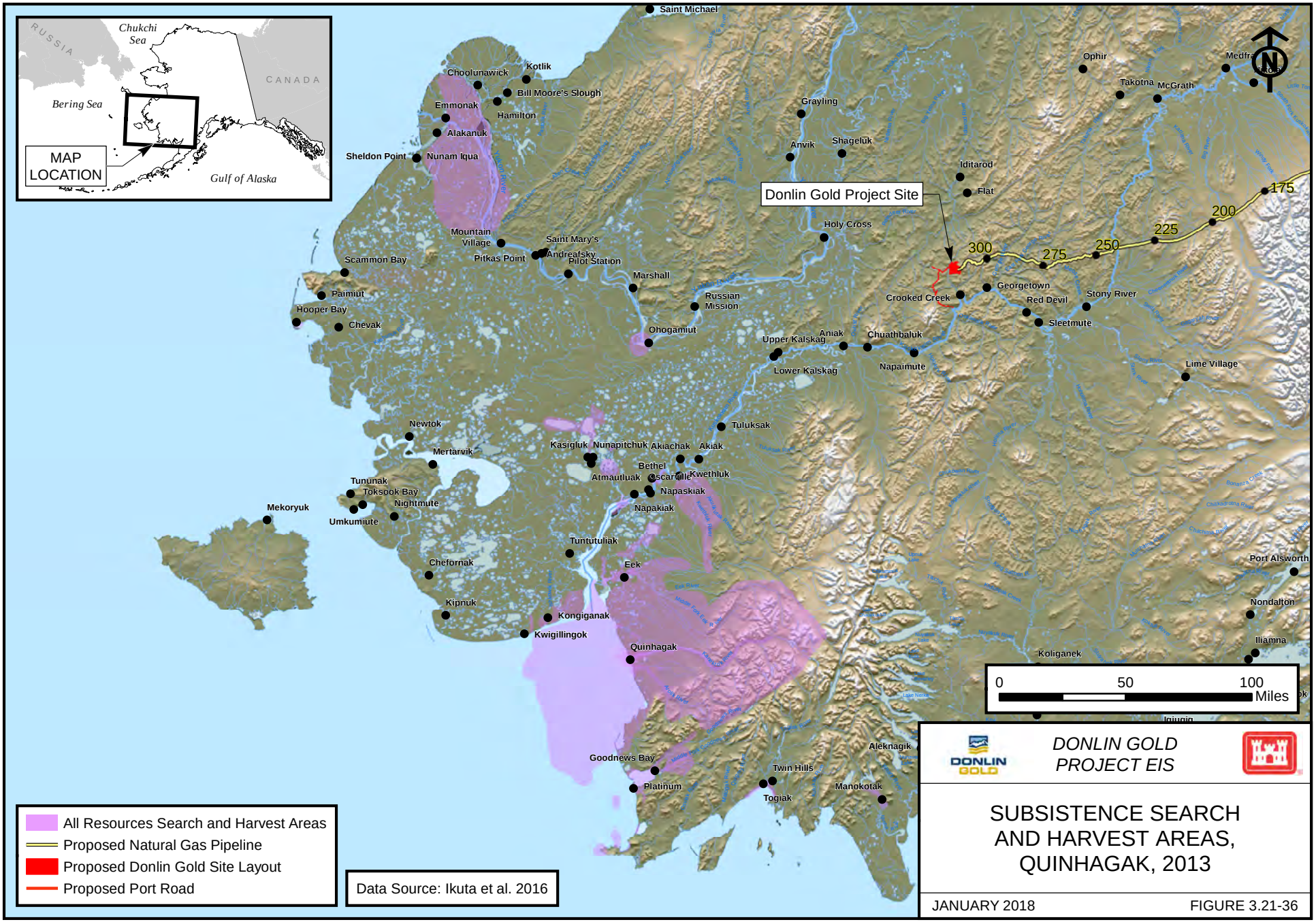
	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Sockeye salmon																								
Chinook salmon																								
Chum salmon																								
Coho salmon																								
Pink salmon																								
Arctic char, Dolly Varden						--	--	--	--	--	--	--												
Round whitefish																								
Lake trout	--	--	--	--	--								--	--	--	--	--	--	--	--	--	--	--	--
Rainbow trout						--	--	--	--	--	--													
Arctic grayling																								
Alaska blackfish																								
Saffron cod, tom cod	--	--											--	--	--	--	--					--	--	--
Flounder																								
Yellowfin sole																								
Smelt																								
Sculpin							--	--	--	--	--													
Roe-on-kelp						--																		
Clams, mussels							--	--																
Crabs											--	--	--											
Moose																								
Caribou																								
Brown bear																								
Bearded seal																								
Ribbon seal																					--	--	--	--
Ringed seal																								
Spotted seal																								
Beluga whale			--	--	--																			
Pacific walrus			--	--																				
Sea lion				--	--																			
Ducks, geese																								
Cranes																								
Duck eggs, gull eggs																								

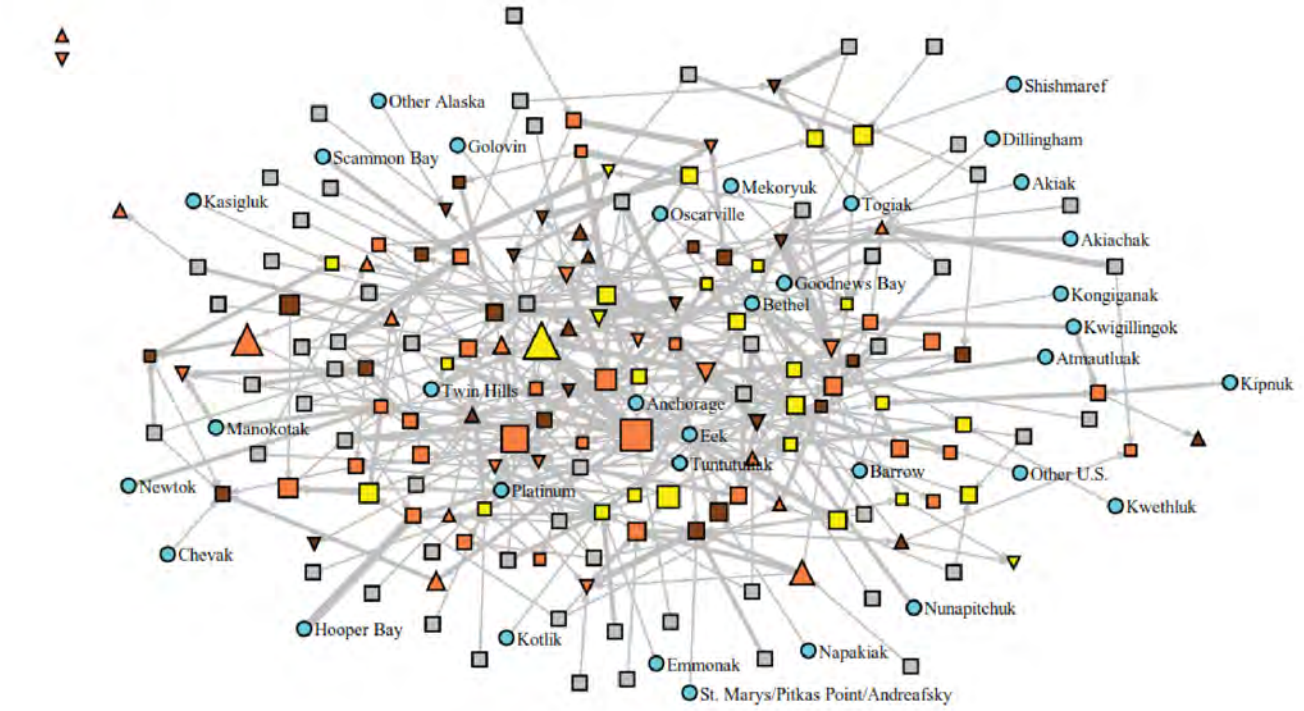
Figure 3.21-35: Quinhagak Seasonal Round of Subsistence Harvests 1983

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Rock ptarmigan																								
Willow ptarmigan																								
Hares				--	--						--	--												
Porcupine	--	--	--	--	--	--									--	--	--	--	--	--	--	--	--	--
Squirrel																								
Beaver																							--	--
Muskrat													--	--	--									
Mink	--	--															--	--			--	--	--	--
Marmot											--	--												
Weasel	--	--															--	--	--	--	--	--	--	--
River otter													--	--										
Red fox																								
Wolf	--	--															--	--	--	--	--	--	--	--
Wolverine	--	--															--	--	--	--	--	--	--	--
Lynx	--	--															--	--	--	--	--	--	--	--
Blackberry																								
Blueberry																								
Cranberry																								
Salmonberry																								
Basket grasses																								
Firewood																								

Notes:
Shaded cells denote concentrated use
-- denotes intermittent use

Source: Wolfe et al. 1984


RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
MAP LOCATION
Saint Michael
Choolunawick
Kotlik
Bill Moore's Slough
Hamilton
Emmonak
Alakanuk
Sheldon Point
Nunam Iqua
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Scammon Bay
Marshall
Paimiut
Hooper Bay
Chevak
Russian Mission
Ohogamiut
Newtok
Mertarvik
Tununak
Toksook Bay
Nightmute
Umkumiute
Mekoryuk
Kasigluk
Nunapitchuk
Akiachak
Akiak
Bethel
Atmautluak
Oscarville
Kwethluk
Napaskiak
Napakiak
Tuluksak
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Goodnews Bay
Platinum
Twin Hills
Togiak
Manokotak
Aleknagik
Grayling
Anvik
Shageluk
Iditarod
Flat
Holy Cross
Donlin Gold Project Site
Ophir
Takotna
McGrath
Medfra
Georgetown
Crooked Creek
Red Devil
Stony River
Sleetmute
Upper Kalskag
Aniak
Chuathbaluk
Lower Kalskag
Napaimute
Lime Village
Port Alsworth
Nondalton
Iliamna
Koliganek
Igiugig
175
200
225
250
275
300
0
50
100
Miles
All Resources Search and Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Data Source: Ikuta et al. 2016
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, QUINHAGAK, 2013
JANUARY 2018
FIGURE 3.21-36



LEGEND

	Age of household head (years)			
	< 40	40 to 59	> 59	Unknown
Couple head				
Single female head				
Single male head				

SYMBOLS are scaled by households' total subsistence harvests (in edible pounds). Surveyed households with many sources of goods and services appear near the center of the figure. Households with fewer sources appear around the edges.

Flows of wild foods from source harvesting and processing households to consuming households, as reported by consuming (surveyed) households

Household not surveyed

Household in other community

LINES are scaled by the number of resources harvested and processed by other households for surveyed households. Arrows point from source households to surveyed households. A household's production for itself is not shown.

Data Source: Ikuta et al. 2016

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, QUINHAGAK, 2013

JULY 2017

FIGURE 3.21-37

3.21.5.5 KUSKOKWIM RIVER SALMON FISHERIES

The Kuskokwim Area subsistence fishery is one of the largest in Alaska. The Kuskokwim Area, defined by ADF&G, corresponds to the Upper Kuskokwim, Central Kuskokwim, Lower-Middle Kuskokwim, Lower Kuskokwim, and Bering Sea Coast (except the communities of Scammon Bay, Hooper Bay, Paimiut, and Chevak) subregions discussed in this section. From June through October the daily activities of many Kuskokwim households revolve around the harvesting and processing of salmon. Residents of the Kuskokwim area harvest five species of Pacific salmon for subsistence purposes: Chinook salmon, chum salmon, coho salmon, pink salmon, and sockeye salmon. Drift gillnetting, set gillnetting and hook and line are the primary methods used to harvest salmon. Dipnets are also used in some communities in response to conservation concerns over Chinook salmon. Salmon not only provide an important source of nutrition, but also are crucial to the maintenance of cultural identity and cultural values (Fall et al. 2011, 2017).

Four of the top five most heavily harvested subsistence resources by Bethel residents in 2012 were salmon species (Ikuta et al. 2017). In other Lower-Middle Kuskokwim communities in 2010 (Oscarville, Kwethluk, Akiak, and Tuluksak) and 2011 (Napakiak and Napaskiak), the five most heavily harvested resources were Chinook salmon (20 percent of total harvest by edible weight), chum salmon (12 percent), northern pike, sockeye salmon, and humpback whitefish (each between 8 and 9 percent) (Brown et al. 2013; Ikuta et al. 2014). In eight Central Kuskokwim communities (Aniak, Chuathbaluk, Crooked Creek, Lower and Upper Kalskag, Red Devil, Sleetmute, and Stony River), four species of salmon comprised 65 percent of the total subsistence harvest by weight (252,458 pounds) in 2009. Chinook salmon alone contributed 30 percent of the total harvest of the eight communities, chum salmon was 15 percent, coho was 12 percent, and sockeye was 8 percent (CL Brown et al. 2012). In three Upper Kuskokwim communities (McGrath, Nikolai, and Takotna), salmon accounted for approximately 22 percent of the total subsistence harvest in 2011 (Ikuta et al. 2014).

Subsistence harvest of Pacific salmon species in the Kuskokwim River is allowed without a permit (5 AAC 01.280) and with no closed season (5 AAC 01.260), unless otherwise noted for conservation purposes. Subsistence fishing on the Kuskokwim can be restricted through closures implemented by emergency order. There are no federal or state harvest limits for subsistence salmon harvests, except when fishing with a rod and reel in the Aniak River upstream of Doestock Creek from June 1 through August 31. The limit is two Chinook salmon.

The ADF&G is responsible for implementing regulations in accordance with the Kuskokwim River Salmon Management Plan (5 AAC 07.365). Waters of the lower Kuskokwim River are largely adjacent to or within federal public lands so ADF&G shares management with the Federal Subsistence Board. The Yukon Delta National Wildlife Refuge Manager is designated as the in-season manager to act on behalf of the Federal Subsistence Board. Established in the mid-1980s, the Kuskokwim River Salmon Management Working Group (KRSMWG) is composed of knowledgeable stakeholders representing local communities, sport fishery representatives, and state and federal management biologists. The working group advises state and federal managers and is the primary forum through which management decisions are made regarding all Kuskokwim river fisheries. Following the signing of a Memorandum of Understanding with the USFWS in in 2016, the Kuskokwim River Inter-Tribal Fisheries Commission has emerged as a primary avenue for consultation with tribes in regard to federal subsistence fishery

management on the Kuskokwim River, working closely with the Federal Subsistence Board and ADF&G.

Data collected since 1989 show a decline in reported Chinook harvests from a high of 114,219 fish in 1990 to a low of 15,434 in 2014 (Table 3.21-14). Coho and chum harvests have also declined (Fall et al. 2014). In 1990, the chum harvest was 157,335 fish compared to a recent 5 year annual average (2009-2013) of 57,338 (Fall et al. 2017). One reason for the decline in chum harvests can be attributed to a lesser need for dog food. Historically, salmon were used to feed dog teams but the number of households harvesting salmon specifically for dogs has declined due to decreased use of dog teams for transportation. In 2014, 10,941 salmon were fed to dogs; most of this was sockeye and chum salmon (Fall et al. 2017). In 2012, severe restrictions were put in place to limit the subsistence harvest and conserve Chinook salmon. As a result of the restrictions it is estimated that 25,353 Chinook salmon were harvested in 2012, which is approximately 25 percent of the harvest during normal years (OSM 2014; Fall et al. 2017), or 67 percent below the recent 10-year average (Fall et al. 2017; Ikuta et al. 2014; see Table 3.21-14).

In response to the poor return (the lowest on record since 1976), in 2012 managers closed fishing on tributaries and in the mainstem of the river. At the June meeting of the KRSMWG, managers recommended a 7 day rolling closure for all subsistence salmon fishing beginning in the lower section of the Kuskokwim River Subdistrict 1-B effective June 10, 2012. By mid-June 2012, the managers implemented 12 day rolling closures or a total of 35 days of restriction in a stepwise progression up the Kuskokwim River consistent with salmon run timing. All restrictions were lifted on July 16 (Fall et al. 2014; Ikuta et al. 2013; Runfola et al. 2017).

The 2013 forecast for the Kuskokwim River indicated there would be enough Chinook salmon to satisfy escapement goals of 65,000 to 120,000 fish and meet subsistence harvest needs of 80,000 fish. However, because the 2012 run had been the lowest on record there was a conservation concern prompting both preseason and in-season subsistence fishing restrictions. In 2013, preseason management actions included closure on subsistence Chinook fishing with hook and line and restriction on gillnet mesh size and length of net in the lower tributaries. Similar restrictions were later implemented in the mainstem of the Kuskokwim River beginning in late June. Each conservation section of the river was subject to 12 days of restrictions in an attempt to allow sufficient numbers of Chinook to reach the spawning grounds. According to a survey of In season Subsistence Salmon Harvesting Monitoring for the Lower Kuskokwim River, in assessing the 2013 fishing season the vast majority of families considered the Chinook catch to be "Very Good," while assessment of chum and sockeye salmon catches were mostly considered "Normal" to "Very Good" (Chavez and Shelden 2014). Middle and upper Kuskokwim River may have experienced less success. In 2013, subsistence users harvested an estimated 46,500 Chinook salmon; more than twice as much as the previous year but still below the long-term average of 72,000 fish (OSM 2014).

For 2014 the Chinook salmon return for the Kuskokwim River was expected to be weak and below normal. As a result, major restrictions were imposed on the fishery. In April of 2014, the Federal Subsistence Board passed a proposal, submitted by the community of Napaskiak, limiting the Chinook salmon fishery to federally qualified subsistence users. The Board adopted a determination under Section 804 of ANILCA that prioritized the subsistence harvests of residents of the Kuskokwim River drainage and the coastal communities of Kwigillingok Kongiganek, Kipnuk, and Cherfornak. Dipnets became legal gear for taking salmon other than Chinook salmon and the mesh size of set and drift gill nets was restricted to four inches. Once

the fishery began in May 2014, the federal in-season and State of Alaska managers instituted rolling closures. In the second week of June 2014, a limited Chinook fishery was open to those communities issued a Social/Cultural Harvest permit. This fishery was allowed in response to requests and formal proposals from tribal groups, the KRSMWG, and the Yukon-Kuskokwim Delta Regional Advisory Council. Fishing was allowed Monday, Wednesdays, and Fridays beginning June 11, 2014 and ending June 30, 2014 (OSM 2014).

In 2015, the Yukon Delta Refuge Manager, acting as the designated federal in-season manager, adopted regulations to limit harvest of Kuskokwim River Chinook salmon on the federally-managed waters of the Yukon Delta NWR, with priority to the communities identified in the Section 804 priority determination of 2014. Federally managed waters on the Refuge were closed to non-federally-qualified users. Chinook harvests by federally qualified subsistence users were restricted to three days per week and gillnets of 4-inch mesh. To provide for a limited harvest opportunity, a voluntary Federal Community Harvest Permit system was implemented, with a harvest quota of 7,000 Chinook salmon. Limitations on subsistence fishing for Chinook salmon were lifted on August 4, 2015 (OSM 2017).

For 2016, the Federal Subsistence Board approved a special action, adopting regulations that closed the federally managed waters of the Yukon Delta Refuge to taking of Chinook and chum salmon by non-federally qualified users, and focusing on the harvests of the communities under the Section 804 prioritization adopted in 2014 and 2015. The Kuskokwim River Inter-Tribal Fish Commission was consulted in regard to actions by the federal in-season manager to limit subsistence fishing areas, timing, and gear. During June, Refuge waters were open to federally qualified subsistence users for the harvest of Chinook and chum salmon brief periods: 12 hours on June 12, 24 hours on June 16, 72 hours on June 21, and 72 hours on June 21. These special actions by the federal in-season manager were rescinded on July 7, 2016 (OSM 2017).

In January 2017, the Kuskokwim River Inter Tribal Fish Commission submitted a special action request proposing a more robust pre-season strategy development, rather than waiting until May to specify the federal in-season management approach. Key elements requested included a conservative escapement target, a focus on the long-term average harvest to meet the customary and traditional need for salmon, and a precautionary buffer. The Board deferred action in its January 2017 meeting, and then the In-season Manager and the Commission held preseason management meetings in March and April 2017, along with a public hearing held in Bethel in mid-April 2017 (OSM 2017). On May 3, 2017 the In-season Manager closed federally managed waters to use of gillnets by all users to provide for escapement of Chinook salmon. Non-gillnet gear was authorized, but all Chinook salmon taken, must be released. The harvest of Chinook salmon was closed to non-federally qualified users (FWB 2017a). On May 24, the Board announced that openings Chinook harvests for federally qualified users (under the Section 804 prioritization of previous years) would be announced by subsequent special action (FSB 2017b). Brief harvest periods for use of gillnets were announced for 12 hours on June 12, for 12 hours on June 24, for 6 hours upriver of Kalskag on July 1, and for 12 hours on July 3 (FSB 2017c, d, e). The announcements noted that the purpose was to provide for harvest on other species, but that incidentally taken Chinook salmon could be retained. On July 7, 2017, all previous federal in-season management actions were rescinded (FSB 2017f).

Table 3.21-14: Historical Subsistence Salmon Harvests, Kuskokwim Area[1], 1989-2014

Year	Households		Estimated Salmon Harvest					
	Total	Surveyed	Chinook	Sockeye	Coho	Chum	Pink	Total
1989	3,422	2,135	85,322	37,088	57,786	145,106	--	325,302
1990	3,317	1,448	114,219	48,752	63,084	157,335	--	383,390
1991	3,340	2,033	79,445	50,383	44,222	89,008	--	263,058
1992	3,308	1,308	88,106	45,994	56,907	119,794	--	310,801
1993	3,269	1,786	92,305	53,442	32,207	64,966	--	242,920
1994	3,169	1,801	111,027	46,172	40,706	89,508	--	287,413
1995	3,638	1,907	105,805	32,019	39,492	72,054	--	249,370
1996	3,630	1,524	100,437	41,644	45,101	102,033	--	289,215
1997	3,501	1,919	83,000	39,868	31,293	38,419	--	192,580
1998	3,497	1,940	85,928	38,296	27,408	73,145	--	224,777
1999	4,165	2,512	80,545	51,321	27,757	52,414	--	212,037
2000	3,317	1,448	75,201	53,498	49,158	72,896	--	250,753
2001	4,469	2,215	81,927	55,163	33,031	57,410	--	227,531
2002	4,804	2,687	84,701	34,890	43,433	94,759	--	257,783
2003	4,513	2,292	70,375	34,772	37,242	47,949	--	190,338
2004	4,638	2,398	102,336	41,558	48,693	65,805	--	258,392
2005	4,603	1,593	90,311	44,933	35,170	59,762	1,343	231,519
2005	4,671	1,439	96,733	47,763	43,211	93,091	2,710	283,508
2007	4,620	1,279	100,297	49,613	35,890	76,281	1,259	263,340
2008	4,735	949	92,977	56,205	47,476	66,275	1,341	264,274
2009	4,808	1,702	83,838	38,795	31,933	46,047	561	201,174
2010	4,215	1,739	70,576	41,722	35,695	46,797	751	195,541
2011	4,241	1,790	65,850	46,290	33,943	55,990	739	202,812
2012	4,294	1,527	25,353	50,781	30,086	82,030	2,160	190,410
2013	4,314	1,755	50,708	42,834	27,841	55,828	741	177,952
2014	4,229	1,862	15,434	53,030	52,587	70,687	2,620	194,358
5-year average (2009-2013)	4,374	1,703	59,265	44,084	31,900	57,338	990	193,578
10-year average (2004-2013)	4,514	1,617	77,898	46,049	36,994	64,791	NA	226,892
15-year average (1999-2013)	4,427	1,822	78,115	46,009	37,371	64,889	NA	227,158
Historical average (1989-2013)	4,020	1,805	84,693	44,952	39,951	76,988	1,289	247,048

Notes:

1 The Kuskokwim Area, defined by the Alaska Department of Fish and Game, corresponds to the Upper Kuskokwim, Central Kuskokwim, Lower-Middle Kuskokwim, Lower Kuskokwim, and Bering Sea Coast (except the communities of Scammon Bay, Hooper Bay, Paimiut, and Chevak) subregions discussed in this section.

-- Data not available

Source: Fall et al. 2017

3.21.5.6 WESTERN COOK INLET AND KUSKOKWIM RIVER MOOSE AND CARIBOU HUNTING

Since moose and caribou are such important and productive subsistence resources through much of the EIS Analysis Area, this section discusses historic perspective, harvest trends over time, and the distribution of harvests among the three major GMUs affected by the Donlin Gold Project, namely 16B, 18, and 19.

Beginning on the west side of Cook Inlet, the Donlin Gold pipeline ROW is located in GMU 16B, which includes the communities of Tyonek, Beluga, Alexander / Susitna, and Skwentna. The eastern portion of this unit, 16A, is designated a non-subsistence area under the State of Alaska management system and would not be affected by the Donlin Gold Project.

3.21.5.6.1 MOOSE

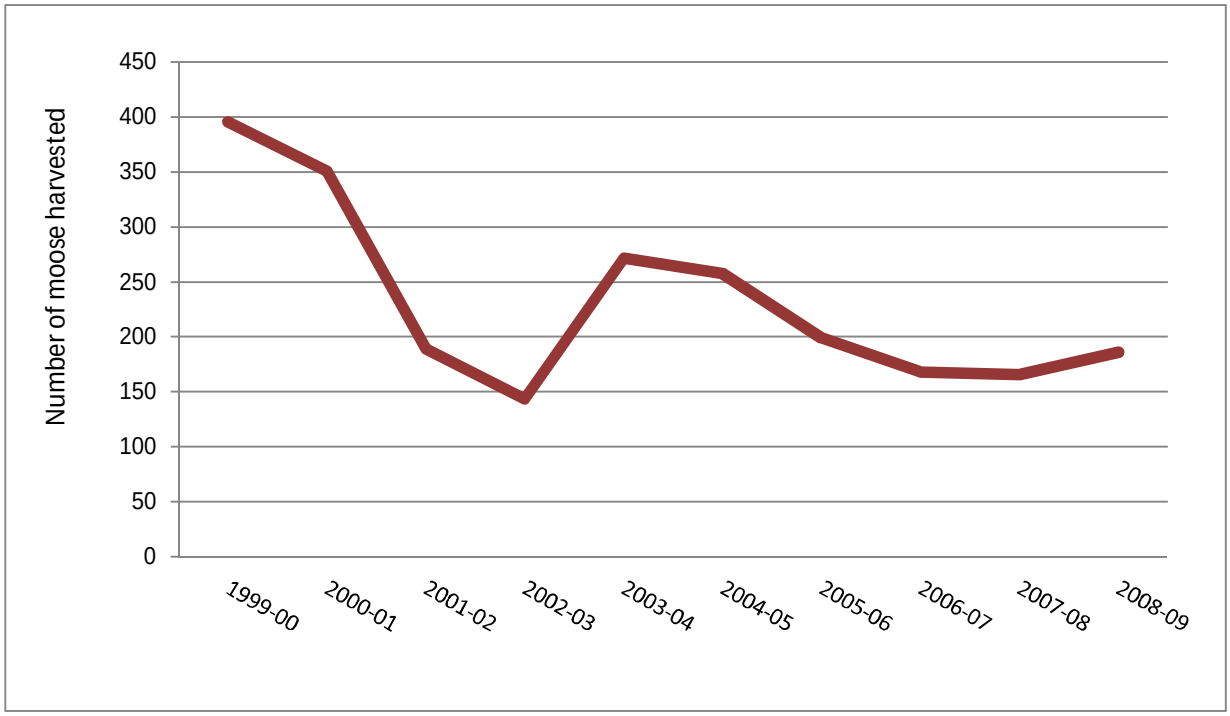
Currently, Alaska residents can hunt moose in GMU 16B under State of Alaska general season regulations, requiring a harvest ticket or a registration permit, or under a State of Alaska Tier II winter / spring hunt for bull moose. Residents of Tyonek, Skwentna, and Beluga reported that they especially rely on the Tier II winter hunt to meet their harvesting goals (Jones et al. 2015; Holen et al. 2014; Stanek et al. 2007). Skwentna and Beluga residents also reported that they face substantial competition from non-locals who put considerable pressure on overwintering moose populations (Stanek et al. 2007; Holen et al. 2014).

Figure 3.21-38 shows moose harvests in GMU 16B from 1999 to 2009. The data reflect all hunters including local and non-local hunters, federal subsistence harvests, and estimated unreported and illegal harvests. The decline in harvests in 2001-2002 and 2006 through 2008 are the result of closed general season hunts produced by a decrease in moose populations (Peltier 2010a). According to ADF&G, moose populations in GMU 16B were lower than those desired by management in 2009-2010 (Peltier 2010a). Both Tyonek and Skwentna residents have reported that moose populations were down compared to previous years (Jones et al. 2015; Holen et al. 2014).

On the upper and central Kuskokwim River drainage, moose arrived at the turn of the 20th century and are now considered a staple food source in many communities. The history of moose hunting regulations in the Kuskokwim River drainage has been dynamic and restrictive in recent decades due to the variability of the moose population. In the early 1990s, populations in GMUs 19A and 19B began declining. The reasons for the decline were varied but as early as 1983 residents of 19A had attributed the decline to increase moose harvest by nonlocal hunters, specifically residents from GMU 18 (CL Brown et al. 2012). Typically, hunters of various backgrounds hunted in both GMUs 19A and 19B, including local and downriver subsistence hunters as well as nonresident hunters.

GMU 19 is divided into four subunits, of which units 19A and 19D are at a lower elevation and accessible by boat, while units 19B and 19C are at higher elevations where access is generally by aircraft. Hunters in 19A and 19D generally live in GMU 19 or downriver in GMU 18, and hunt primarily for food (Seavoy 2010). Communities in 19A include Lime Village, Stony River, Sleetmute, Red Devil, Georgetown, Crooked Creek, Napaimute, Chuathbaluk, Aniak, Kalskag, and Lower Kalskag. Communities in GMU 19D include Telida, Nikolai, Medfra, McGrath, and Takotna.

Figure 3.21-38: Estimated Moose Harvests, GMU 16B, 1999-2009



Notes:
These data include all hunters and all reported harvests including Federal Subsistence harvests as well as estimated unreported and illegal harvests.

Source: Peltier 2010a.

GMU 18 encompasses all of the communities in the Lower Kuskokwim subregion, the Bering Sea Coast subregion, mouth of the Yukon subregion, the Lower Yukon subregion, and the Lower-Middle Kuskokwim subregion. Moose densities in GMU 18 are moderate to high in the Yukon River drainage and low in the Kuskokwim River drainage. According to ADF&G, hunting pressure from communities along the Kuskokwim River has limited the growth of the moose population along the river corridor in GMU 18 (Perry 2010a).

Regulations for GMU 19 were flexible enough during the 1990s to satisfy all users groups but as moose populations declined and competition increased regulations became more conservative resulting in the complete closure of winter moose hunts in 2000 and 2001 and partial closures (to nonresident hunters) in 2002. To address the issue of declining moose populations, ADF&G and the Central Kuskokwim Fish and Game Advisory Committee established the Central Kuskokwim Moose Planning Committee in 2002. The resulting Central Kuskokwim Moose Plan (CKMP), instituted in 2004, included closure of nonresident hunting in GMU 19A, a registration hunt in 19A with permits to be issued within the subunit, and predator control. Updated moose population estimates from 2005 led the Alaska Board of Game (BOG) to implement even more conservative regulations in 2006, but a disagreement arose between communities in the CKMP. Communities in the eastern portion of GMU 19A wanted a complete closure on moose hunting while those in the western portion did not. Since 2006 there has been a moratorium on moose hunting in the eastern portion of GMU 19A. Red Devil, Sleetmute, and Stony River are within the closed area. The remainder of GMU 19A has been open to moose hunting under Tier II permit system on state land, and to federal hunts under the provisions of Section 804 of ANILCA on federal lands.

For the regulatory year 2006-2007 the BOG instituted a Tier II hunt in GMUA 19A that encompassed the area from the George River drainage down river to Upper Kalskag (Brown et al. 2013). Hunting was closed in the remainder of Unit 19A. Almost all residents of the state of Alaska are eligible to fill out a Tier II application – which measures dependence on moose within a particular GMU. Permits are awarded to applicants with the highest scores, reflecting their long-term use of the area and reliance on moose. Federal hunts are open only to federally qualified users who reside in a specific area in which residents have established a history of use of the resource. For many residents of GMU 19A Tier II permit regulations are perceived as unfair because they think most of the permits go to hunters residing outside GMU 19A, in particular to residents of GMU 18 (CL Brown et al. 2012).

In GMU 18 between 1960 and 2003, hunting regulations allowed one bull moose under general hunt provisions. However, heavy hunting pressure limited the growth of the moose population so in 2004-2005 the BOG instituted a moratorium on moose hunting in the lower Kuskokwim drainage. In 2009-2010, the moratorium was lifted and a registration hunt was instituted, which is extremely competitive with approximately 1,000 hunters requesting permits. According to ADF&G, there are several factors influencing the moose harvests of communities in GMU 18 that are located in the Kuskokwim River drainage: a poor cash economy, coupled with a decline in commercial fishing opportunities, a decline in the Mulchatna caribou herd, and continued growth in the local human population (Perry 2010a).

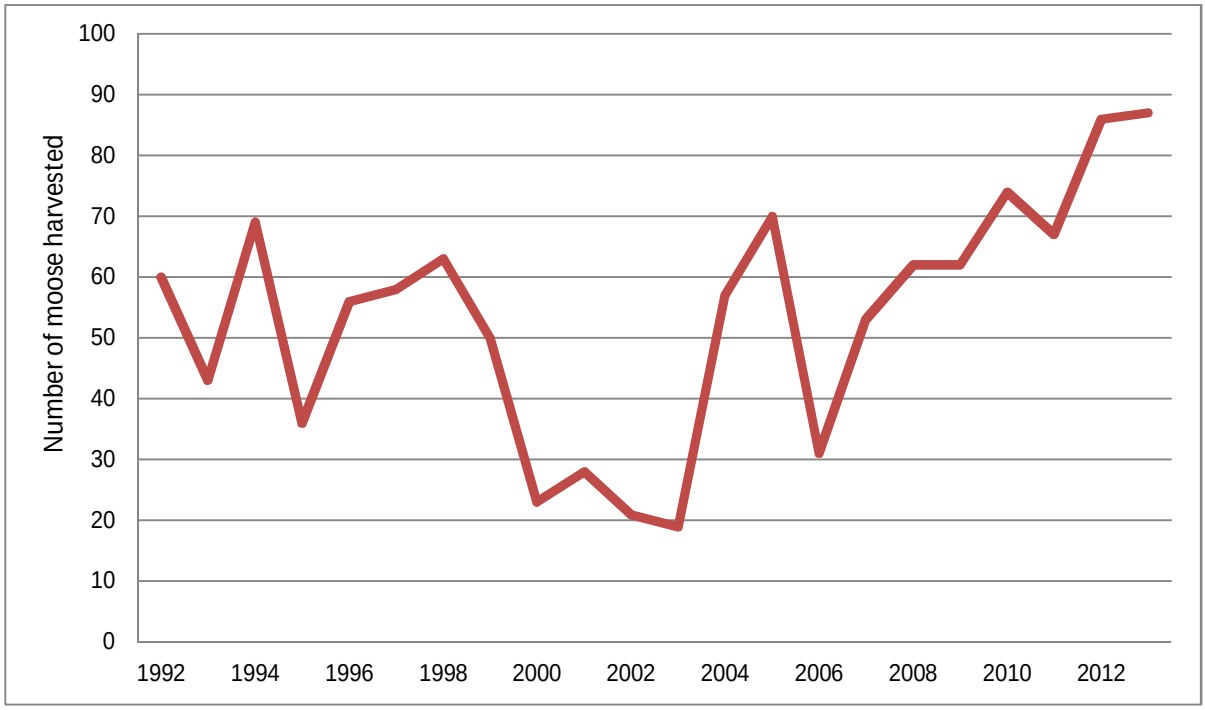
In recent decades, Lower Kuskokwim communities of GMU 18 have a history of traveling long distances to hunt moose. For example, in 1998 an estimated 43 percent of successful Akiachak moose hunters harvested moose outside the lower Kuskokwim region with a majority of the harvest taking place in the central Kuskokwim region (i.e., GMU 19). This resulted in growing user conflicts and the BOG established the Holitna/Hoholitna Controlled Use Area where there is no big game hunting with any boat equipped with a motor larger than 40 horsepower (Brown et al. 2013). Very few hunters from GMU 19 hunt in other GMUs such as 18 and 21E. Trips are generally cost prohibitive because of the price of fuel, opportunity costs from the loss of wages, lack of family or social contacts outside their traditional hunting territories, and lack of familiarity with new hunting territories.

Figure 3.21-39 shows the fluctuation in moose harvests by communities in GMU 19A. Data were collected from ADF&G harvest tickets and include community harvests in both GMUs 18 and 19. In 2009, moose comprised from 0 to 17 percent of the total subsistence harvest in Red Devil, Sleetmute, and Stony River. In the western half of GMU 19A, where there is a Tier II hunt, moose made up a greater percentage of the total harvest. As result of lower moose harvest levels, residents may be shifting to fish, and other resources such as beavers and black bears.

Figure 3.21-40 shows a strong increase in subsistence moose harvests by residents of all communities located in GMU 18.

Figure 3.21-41 shows the geographic distribution and density of moose hunters over a 13-year period, between 2002 and 2014 in GMUs 16B, 18 and 19. Data for this figure was supplied by ADF&G, Division of Wildlife Conservation. The map shows data for hunters from local communities only and does not include non-local or non-Alaska resident hunters. Highest densities are in GMU 18 and 19A along the river corridors and in the vicinity of communities. Medium densities occur along portions of the Pipeline in 16B, 19A, and 19D. Lighter densities occur in the eastern portion of 19A where there has been a moratorium on moose hunting.

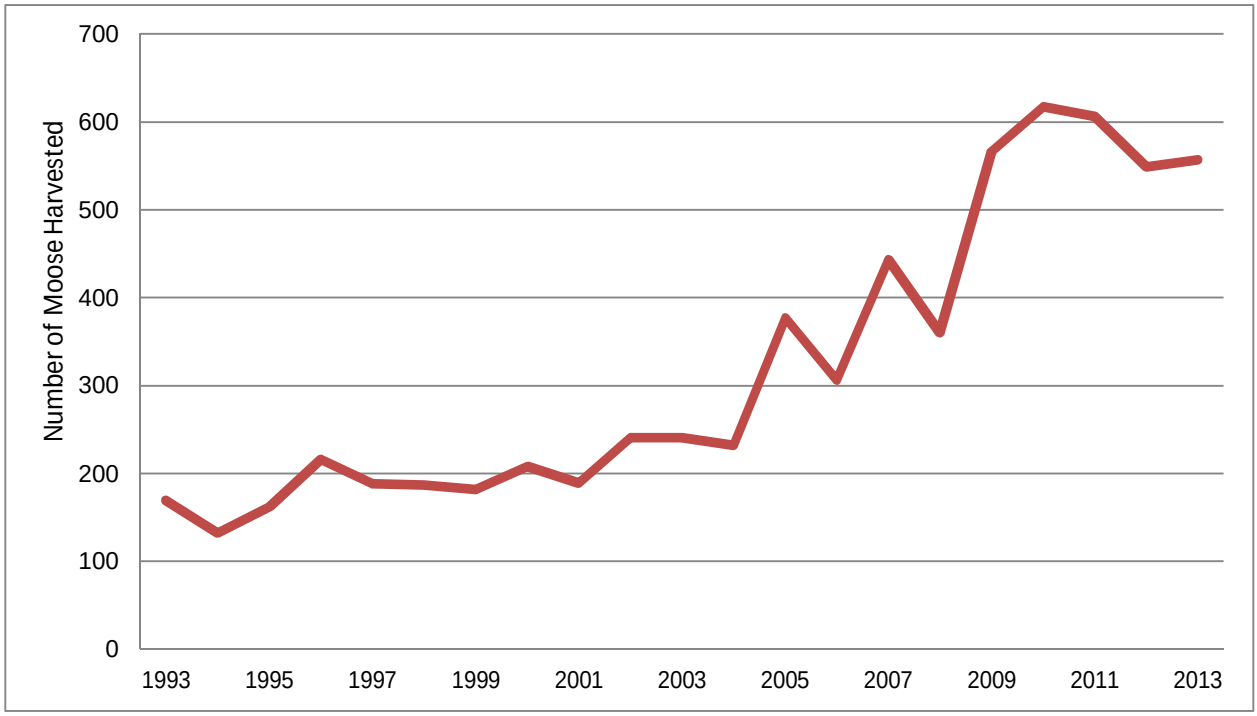
Figure 3.21-39: Historical Subsistence Moose Harvest, GMU 19A Communities, 1992-2013



Note:
These data include local hunters from communities in GMU 19A who successfully hunted in GMUs 18 and 19 between 1992 and 2013. It does not include non-local hunters.

Source: ADF&G 2015e.

Figure 3.21-40: Historical Subsistence Moose Harvest, GMU 18 Communities, 1992-2013



Note:
These data include local hunters from communities in GMU 18 who successfully hunted in GMUs 18 and 19 between 1993 and 2013. It does not include non-local hunters.

Source: ADF&G 2015e.

3.21.5.6.2 CARIBOU

The primary caribou herd hunted by residents of GMUs 18 and 19 is the Mulchatna Herd. Between 1981 and 1996, this herd increased at a substantial rate due in part to a succession of mild winters, expansion into previously unused range, and low predation and harvests rates (Woolington 2011). In subsequent years, the population has declined from its peak in 1996 as the distribution of animals has become more widespread.

State of Alaska bag limits for caribou have reflected fluctuations in the herd; with a limit of five caribou in the regulatory years 1997-1998/2005-2006 for the portion of GMU 18 south of the Yukon River. For all of GMU 18 in the 2006-2007 regulatory year, the harvest was limited to three caribou, then the following year (2007-2008) the limit was two caribou, which remained as the limit through the 2013-2015 regulatory year (Brown et al. 2013, Runfola et al. 2017). As herd distribution has changed, so has the harvest. For example in recent years caribou contributed 4 percent to the total subsistence harvest by edible weight in Lower Middle Kuskokwim communities (Akiak, Kwethluk, Oscarville, and Tuluksak, Napakiak, Napaskiak) (Brown et al. 2013; Ikuta et al. 2014), while in Upper (McGrath, Nikolai, Takotna and Telida) and Central Kuskokwim communities (Aniak, Chuathbaluk, Crooked Creek, Lower Kalskag, Red Devil, Sleetmute, Stony River and Upper Kalskag) caribou contributed one percent or less to the total harvest (Ikuta et al. 2014; CL Brown et al. 2012). Figure 3.21-42 shows the number of successful caribou hunters from communities within the range of the Mulchatna caribou herd from 1991 to 2010.

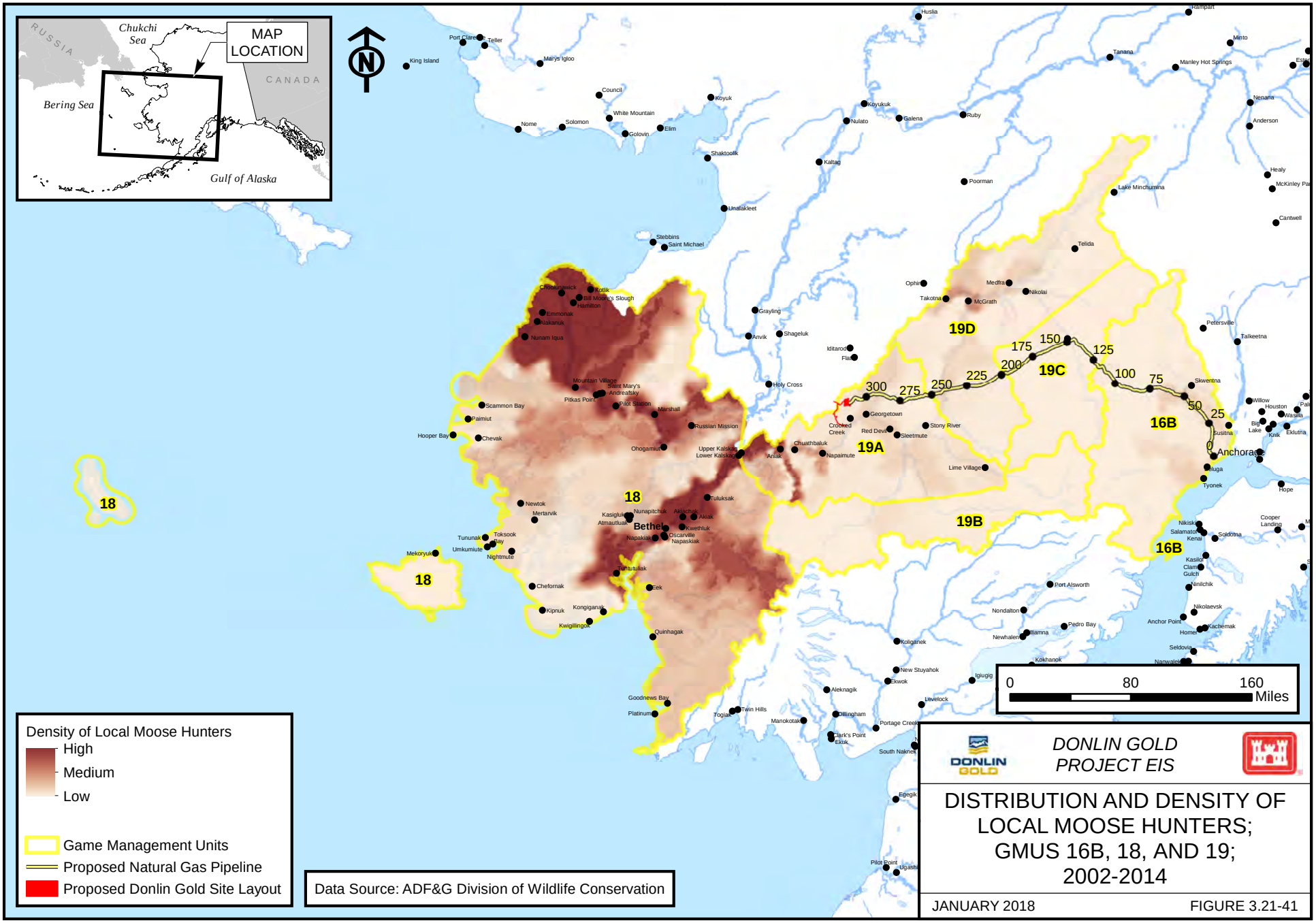
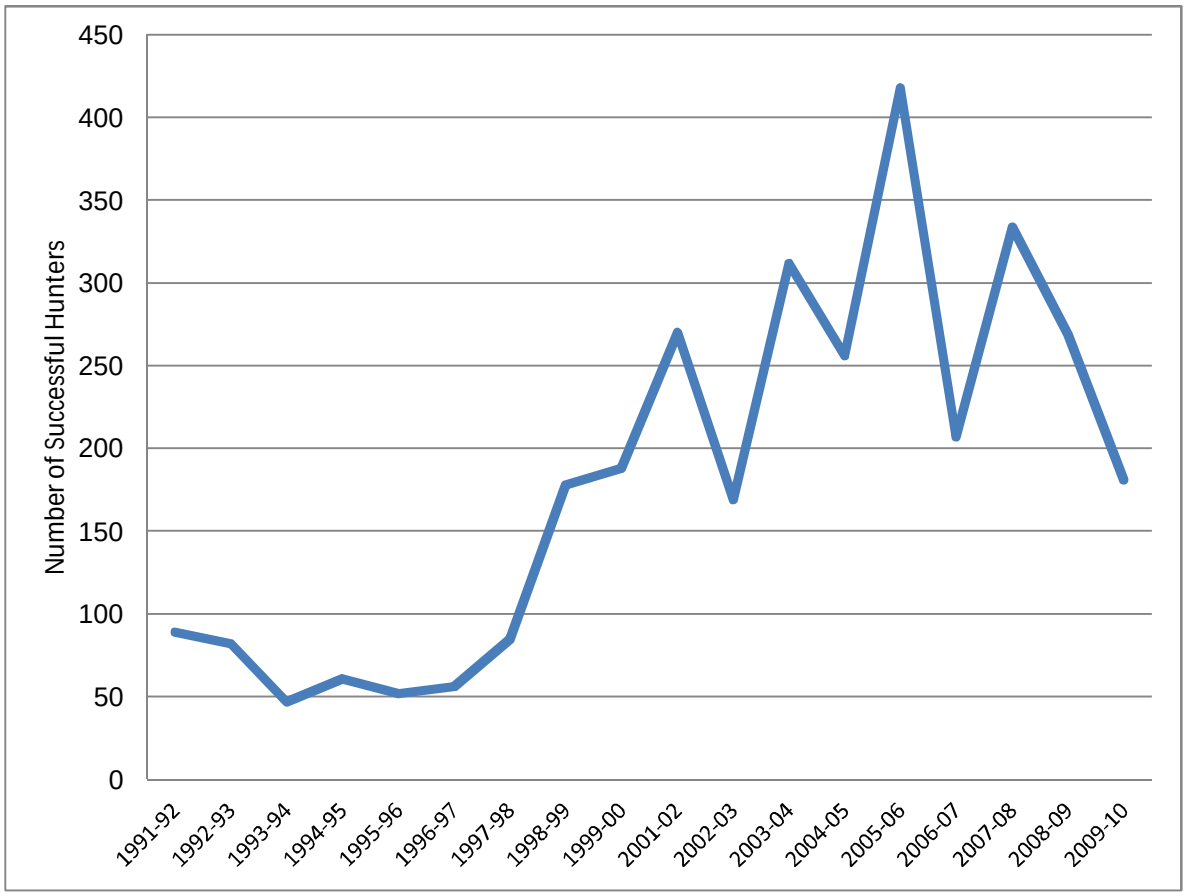

MAP LOCATION
Chukchi Sea
Bering Sea
Gulf of Alaska
RUSSIA
CANADA
N
Density of Local Moose Hunters
High
Medium
Low
Game Management Units
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Data Source: ADF&G Division of Wildlife Conservation
18
19A
19B
19C
19D
16B
Bethel
Anchorage
0 80 160 Miles
DONLIN GOLD PROJECT EIS
DISTRIBUTION AND DENSITY OF LOCAL MOOSE HUNTERS; GMUS 16B, 18, AND 19; 2002-2014
JANUARY 2018
FIGURE 3.21-41

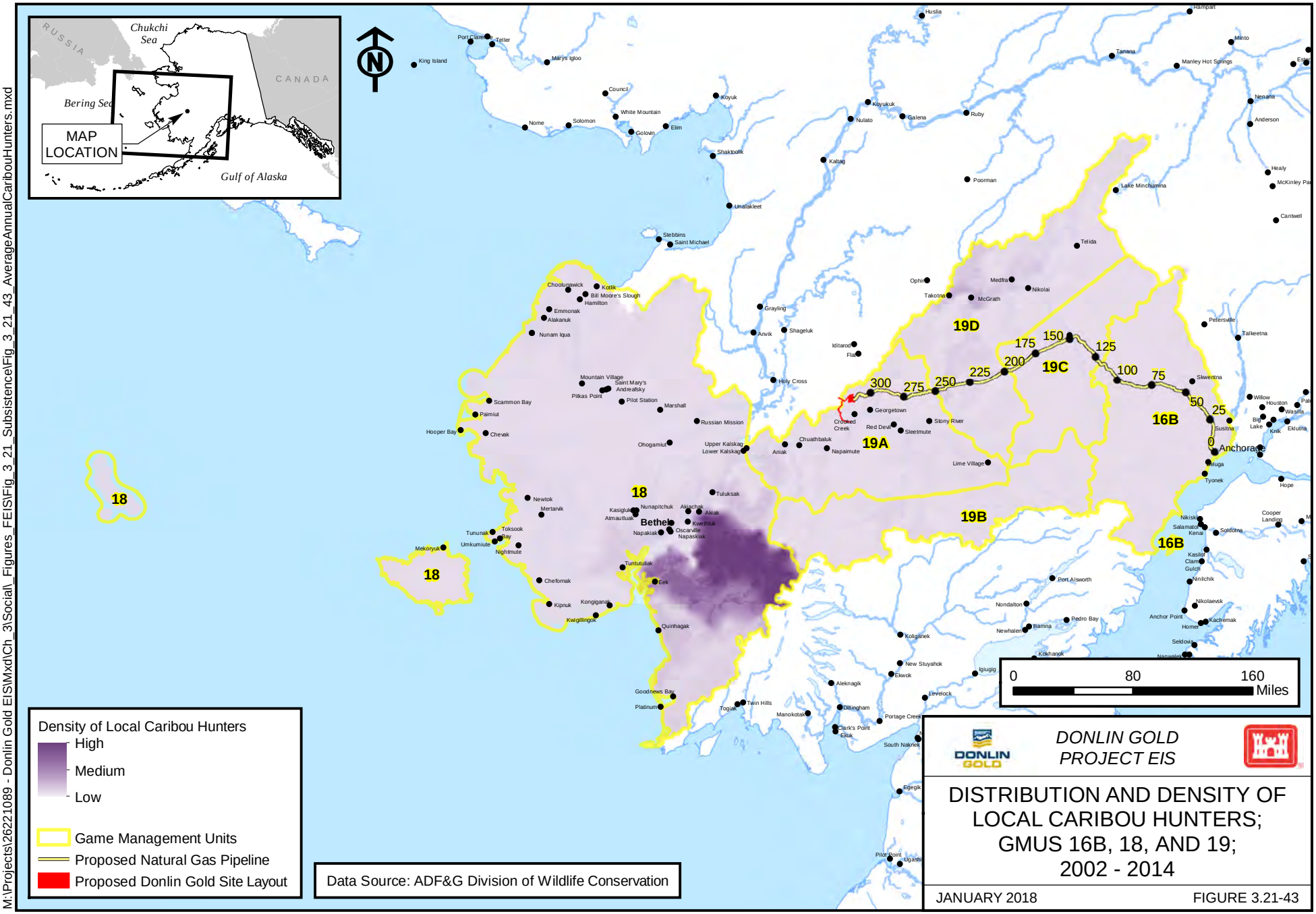
Figure 3.21-43 shows the geographic distribution and density of caribou hunters over a 13 year period, between 2002 and 2014 in GMUs 16B, 18 and 19. The highest density occurs in the Lower Kuskokwim area where the caribou are concentrated. Medium density occurs along portions of the Upper Kuskokwim River around McGrath and Nikolai. In 2011, based on survey result of a sample, the expanded estimate for McGrath residents' harvest was only 2.6 caribou for the entire community and Nikolai residents' expanded estimate was only 1.5 caribou (Ikuta et al. 2014). In contrast, Kwethluk residents, located in the high-density area, the expanded estimate was a community harvest of 110.8 caribou (Brown et al. 2013).

Figure 3.21-42: Successful Caribou Hunters from Communities within the Mulchatna Caribou Herd Range, 1991-2010



Notes:
* Includes residents of communities within the range of the Mulchatna caribou herd.

Source: Woolington 2011


MAP LOCATION
Chukchi Sea
Bering Sea
RUSSIA
CANADA
Gulf of Alaska
N
Density of Local Caribou Hunters
High
Medium
Low
Game Management Units
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Data Source: ADF&G Division of Wildlife Conservation
0 80 160 Miles
18
19A
19B
19C
19D
16B
Bethel
Anchorage
DONLIN GOLD PROJECT EIS
DISTRIBUTION AND DENSITY OF LOCAL CARIBOU HUNTERS; GMUS 16B, 18, AND 19; 2002 - 2014
JANUARY 2018
FIGURE 3.21-43
M:\Projects\26221089 - Donlin Gold EIS\Mxd\Ch_3\Social_Figures_FEIS\Fig_3_21_SubsistenceFig_3_21_43_AverageAnnualCaribouHunters.mxd

3.21.5.7 SUBSISTENCE HARVEST PATTERNS: BERING SEA COAST SUBREGION

Communities included in the Bering Sea Coast subregion are Kipnuk, Chefornak, Nightmute, Mekoryuk, Toksook Bay, Tununak, Newtok, Chevak, Hooper Bay, Paimiut, and Scammon Bay. Paimiut has no resident population. Subsistence resources are harvested year round in this subregion. Figure 3.21-44 illustrates the seasonal round of Hooper Bay as an example for the Bering Sea Coast subregion. Comprehensive harvest data are lacking for most of the Bering Sea coast villages. There is limited harvest data for Tununak, but the technical paper for Tununak is confined to a discussion about herring. There is a technical paper covering subsistence in Hooper Bay, although the data are qualitative. Scammon Bay is highlighted of this subregion because it is the only community for which recent comprehensive harvest data are available.

3.21.5.7.1 SCAMMON BAY

Scammon Bay is a Yup'ik community located in the Yukon-Kuskokwim Delta at the mouth of the Kun River which flows into the waterbody of Scammon Bay. The City of Scammon Bay was incorporated as a second-class city in 1967. In 2014, Ikuta et al. (2016), researchers from ADF&G, surveyed 86 of 123 households in Scammon Bay to gather information on the 2013 subsistence harvest. Ikuta et al. (2016) estimated that the population of Scammon Bay in 2013 was 628 people. The results of the study showed that Scammon Bay residents harvested an estimated 262,095 pounds of edible subsistence resources, or 417 pounds per capita. Table 3.21-15 shows the per capita subsistence harvest for the main resource categories and selected species.

Figure 3.21-44: Hooper Bay Seasonal Round of Subsistence Harvests 1984

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Bearded seal						--	--					--	--			--								
Ringed seal						--	--													--	--	--	--	--
Spotted seal						--	--				--	--	--			--								--
Walrus			--	--	--	--																		
Beluga whale		--	--	--	--	--																		
Bering cisco		--						--	--	--					--						--	--	--	
Herring					--		--																	
Chinook salmon						--																		
Chum salmon						--																		
Pink salmon						--																		
Starry flounder						--							--											
Tomcod		--										--				--			--					
Sculpins						--							--											
Least cisco		--									--	--									--	--	--	
Pike										--	--	--												
Blackfish	--	--											--	--	--									--
Needlefish																	--	--	--	--	--	--	--	--
Burbot																								
Mink																								
Red fox																					--			
Arctic fox																								
River otter	--	--																		--	--	--	--	--
Snowshoe hare			--														--	--	--	--	--			
Tundra hare			--														--	--	--	--	--	--		
Willow ptarmigan				--																	--	--	--	
Rock ptarmigan	--	--	--	--																				

Figure 3.21-44: Hooper Bay Seasonal Round of Subsistence Harvests 1984

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb	
Salmonberry												--												
Crowberry												--												
Lingonberry				--	--	--							--			--								
Basket grasses													--											
Mouse foods													--											
Driftwood	--	--	--	--	--	--	--	--	--	--	--	--				--								

Notes:
Shaded cells denote concentrated use
-- denotes intermittent use
Source: Stickney 1984

Table 3.21-15: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Resource Categories and Selected Species, Scammon Bay, 2013

All Resources	**417.4**
Marine Mammals	**84.5**
Beluga whale	38.2
Bearded seal	18.2
Ringed seal	16.8
Spotted seal	5.0
Walrus	5.3
Large Land Mammals	**81.7**
Black bear	0.9
Caribou	2.1
Moose	78.7
Small Land Mammals	**0.4**
Beaver	0.1
Coyote	0.0*
Red fox	0.0*
Snowshoe hare	0.1
Alaska hare	0.2
River otter	0.0*
Lynx	<0.1
Mink	0.0*
Muskrat	0.0*
Salmon	**85.4**
Summer chum	71.4
Fall chum	1.2
Chinook	6.9
Pink	4.0
Non-Salmon Fishes	**103.2**
Pacific halibut	31.5
Saffron cod	17.0
Pacific herring	16.1
Northern pike	11.0
Marine Invertebrates	**1.2**
Birds and Eggs	**40.2**
Northern pintail	2.1
Brant	7.7

Table 3.21-15: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Resource Categories and Selected Species, Scammon Bay, 2013

Cackling goose	2.9
White-fronted goose	9.0
Snow goose	2.4
Sandhill crane	5.8
Ptarmigan	2.7
Bird eggs	2.5
Vegetation	**20.8**

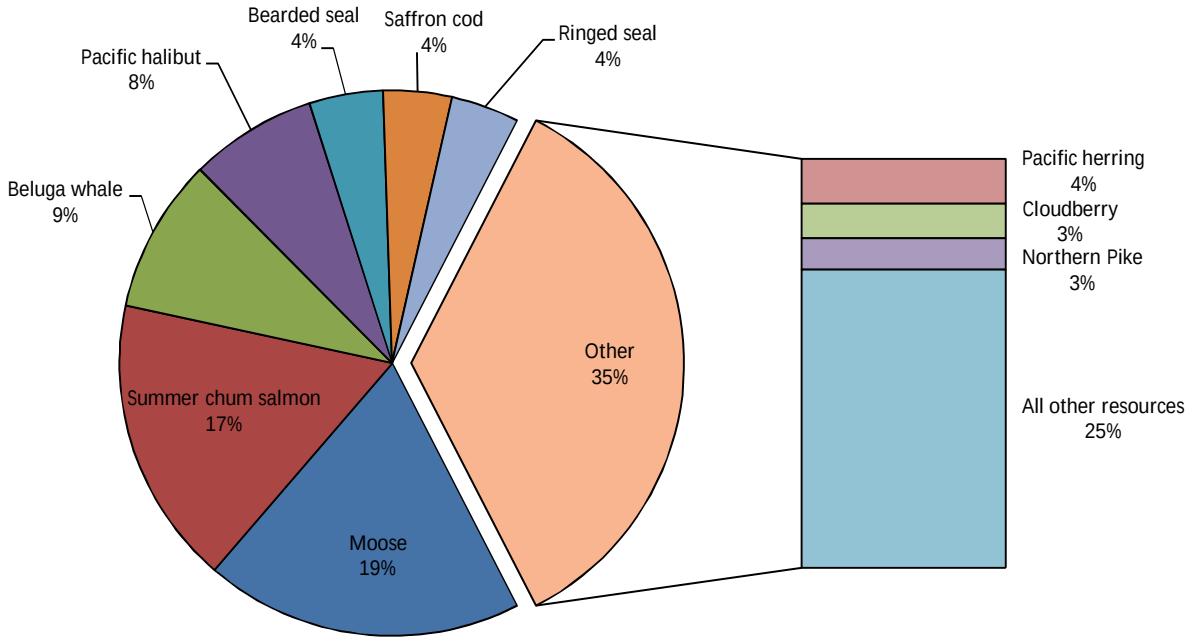
Notes:
Per capita harvest estimated using a population of 627.9
* Small mammal species that were harvested, but are not typically eaten. Harvest weight was not calculated for species harvested but not eaten.

Source: Ikuta et al. 2016

Species Harvest and Use: Surveyed households in Scammon Bay harvested an average of 22 kinds of subsistence resources and used an average of 31 different resources during 2013. As shown in Figure 3.21-45, the top ten subsistence resources in Scammon Bay made up 75 percent of the harvest by edible weight. Moose made up the largest portion (19 percent) of the wild food harvest by edible weight. Summer chum was the second most harvested species and accounted for 17 percent of the edible harvest by weight. Summer chum also dominated the Scammon Bay salmon harvest, comprising 83 percent of the 53,623 edible pounds of salmon harvested in 2013. Marine mammal and non-salmon fish species were also important wild food resources in Scammon Bay. The remaining subsistence resources in the top ten were beluga whale (9 percent of the harvest by edible weight), Pacific halibut (8 percent), bearded seal (4 percent), saffron cod (4 percent), ringed seal (4 percent), Pacific herring (4 percent), cloudberry (3 percent), and northern pike (3 percent).

Ikuta et al. (2016) estimated that all Scammon Bay households used wild foods or other subsistence resources in 2013 and virtually all (99 percent) of households reported harvesting subsistence resources. Seven subsistence resources were used by at least three quarters of Scammon Bay households in 2013: moose (used by 98 percent of households), cloudberry (92 percent), summer chum salmon (91 percent), cackling goose (85 percent), crowberry (83 percent), Chinook salmon (76 percent), and wood (75 percent). A majority of Scammon Bay households reported harvesting vegetation (harvested by 92 percent of households), non-salmon fishes (88 percent), birds and eggs (81 percent), salmon (66 percent), large land mammals (56 percent), and marine mammals (56 percent) (Table 3.21-16).

Figure 3.21-45: Composition of Scammon Bay Subsistence Harvest by Estimated Edible Weight, 2013



Source: Ikuta et al. 2016

Seasonal round: Scammon Bay residents increase their hunting and fishing activities in spring. Spring fishing targets include saffron cod, rainbow smelt, northern pike, burbot, and whitefishes. Ptarmigan and occasionally hares and lynx are hunted in early spring. Hunters also travel to open leads in sea ice to hunt seals and walrus. Pacific herring arrive in the coastal areas around Scammon Bay in mid-May. Salmon fishing begins with the arrival of the first Chinook and summer chum salmon and continues throughout summer. Pacific halibut and whitefishes are also harvested in summer. Migratory waterfowl hunting continues into late spring and egg gathering occurs simultaneous with gathering the first spring greens. Beluga whale hunting occurs in late spring and early summer. In late July and August, Scammon Bay residents harvest large quantities of berries. Fish, marine mammals, and molting waterfowl are also harvested during this time. After berry-picking season, moose hunting begins. As moose hunting decreases in late September, Scammon Bay residents begin hunting large numbers of migrating waterfowl. Harvest of non-salmon fishes, seals, and walrus continues through the winter. Furbearers are harvested in winter (Ikuta et al. 2016).

Table 3.21-16: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Scammon Bay, 2013

	Percentage of Households			
	Using	**Harvesting**	**Receiving**	**Giving Away**
All Resources	**100.0**	**98.8**	**96.5**	**93.0**
Salmon	**97.7**	**66.3**	**68.6**	**51.2**
Chinook	75.6	44.2	41.9	23.3
Summer chum	90.7	62.8	40.7	41.9
Fall chum	10.5	2.3	8.1	2.3
Coho	22.1	11.6	12.8	4.7
Sockeye	11.6	8.1	3.5	2.3
Pink	30.2	23.3	9.3	11.6
Non-Salmon Fishes	**97.7**	**88.4**	**77.9**	**74.4**
Pacific halibut	74.4	44.2	38.4	37.2
Saffron cod	73.3	68.6	8.1	26.7
Pacific herring	52.3	33.7	19.8	24.4
Northern pike	53.5	43.0	12.8	19.8
Large Land Mammals	**97.7**	**55.8**	**76.7**	**58.1**
Caribou	20.0	3.5	16.5	5.9
Moose	97.7	55.8	67.4	55.8
Black bear	5.8	4.7	1.2	3.5
Small Land Mammals	**24.4**	**23.3**	**3.5**	**10.5**
Beaver	3.5	3.5	0.0	0.0
Red fox	9.3	9.3	0.0	3.5
Snowshoe hare	8.1	8.1	0.0	3.5
Alaska hare	10.5	10.5	0.0	7.0
Marine Mammals	**90.7**	**55.8**	**72.1**	**52.3**
Beluga whale	65.1	20.9	52.9	25.6
Bearded seal	67.4	37.2	41.9	36.0
Ringed seal	69.8	46.5	29.1	38.4
Spotted seal	40.7	27.9	17.4	20.9
Walrus	19.8	3.5	16.3	5.8
Marine Invertebrates	**48.8**	**41.9**	**17.4**	**17.4**
Birds and Eggs	**91.9**	**81.4**	**59.3**	**55.8**
Northern pintail	41.9	31.4	11.6	11.6
Brant	46.5	39.5	9.4	15.3
Cackling goose	84.9	70.9	20.0	38.4

Table 3.21-16: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Scammon Bay, 2013

	Percentage of Households			
	Using	**Harvesting**	**Receiving**	**Giving Away**
White-fronted goose	72.1	60.5	15.3	24.7
Sandhill crane	61.6	46.5	18.8	18.8
Vegetation	**96.5**	**91.9**	**48.8**	**57.0**
Cloudberry	91.9	87.2	18.6	37.2
Crowberry	82.6	77.9	8.2	20.0
Wood	75.3	65.9	23.5	18.8

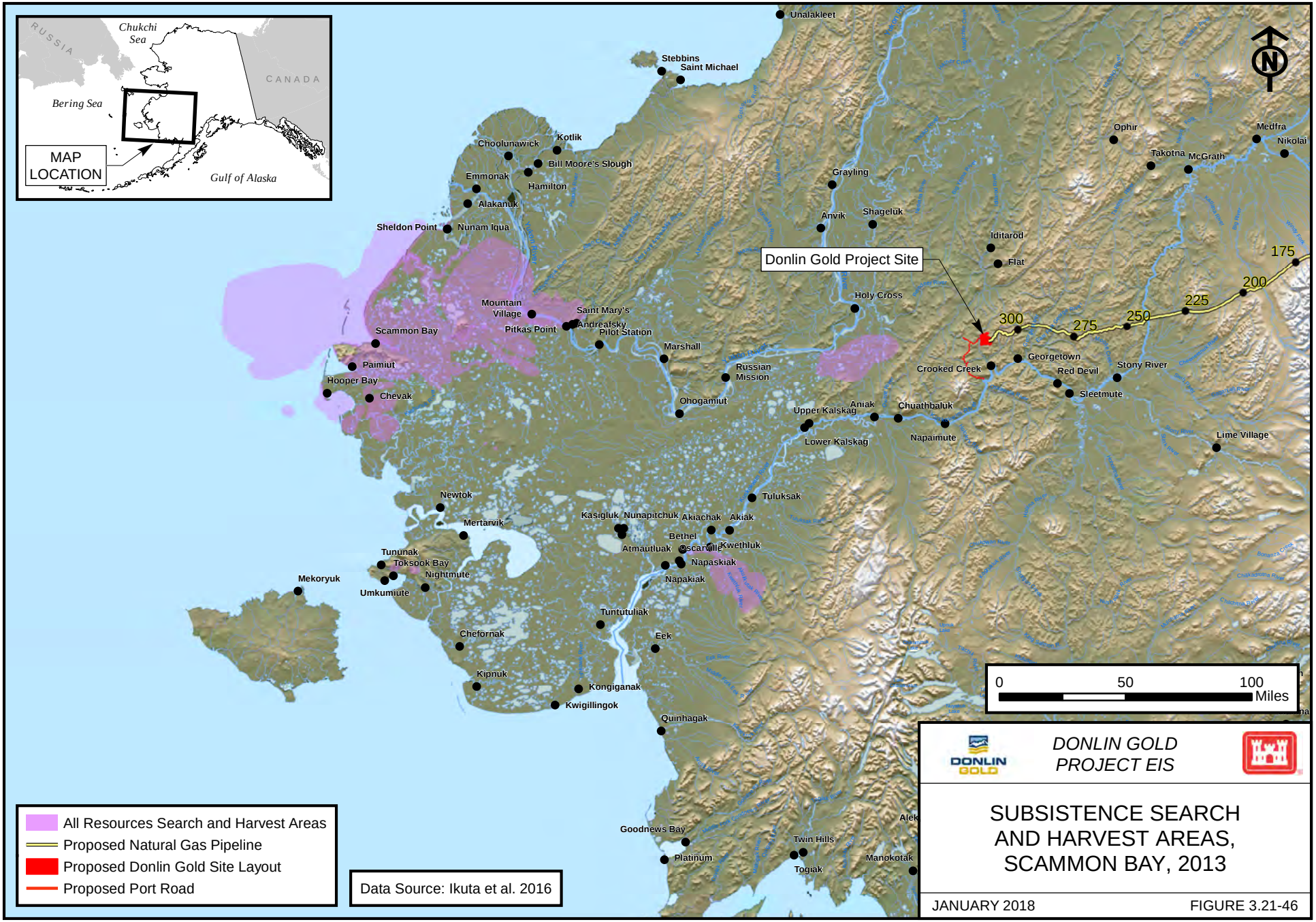
Notes:
Data based on surveys of 86 of 123 households in Scammon Bay
Source: Ikuta et al. 2016

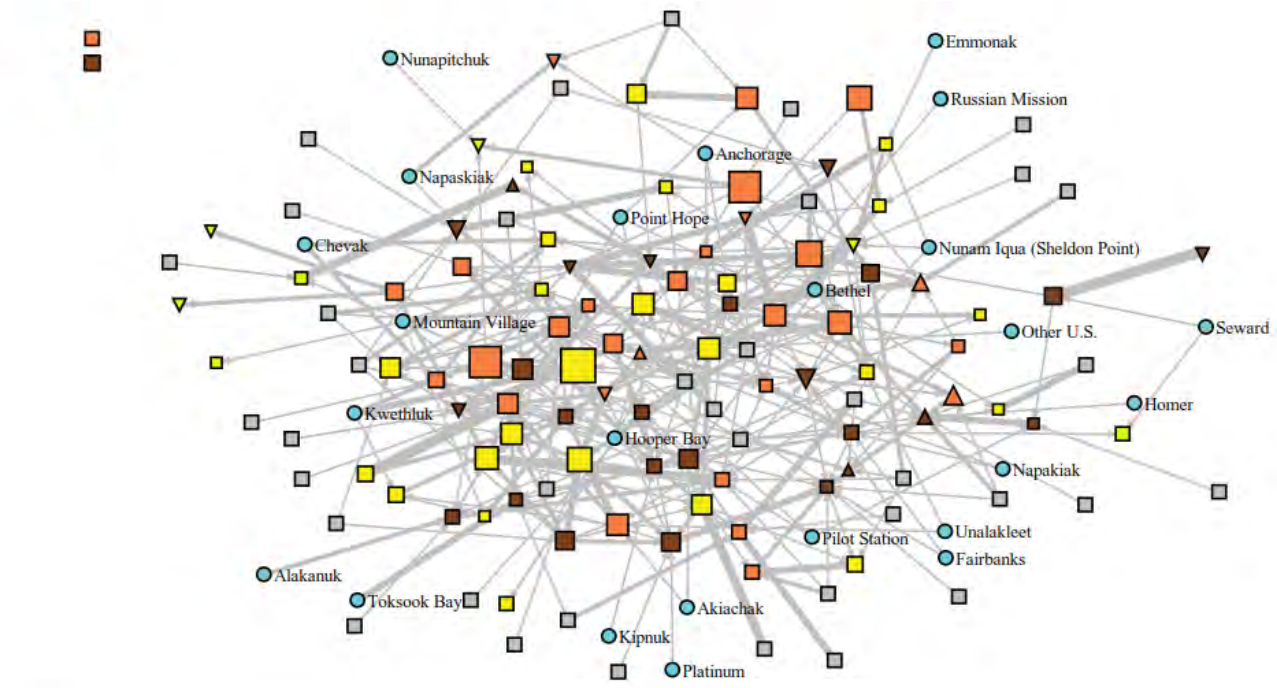
Harvest Areas: Scammon Bay survey respondents reported using a combined 6,625 square miles for subsistence search and harvest in 2013. The primary focus of harvest effort for all resources occurred in an area extending from Saint Mary's west into the Bering Sea, including areas of the lower Yukon drainage, and the Black, Kun, Kokechik, and Kashunuk rivers. Subsistence activities also occurred in the vicinity of Chevak and Hooper Bay and locations on Nelson Island, Ingakslugwat Hills, Paimiut Slough, and part of the lower Kwethluk River drainage (Figure 3.21-46) (Ikuta et al. 2016).

Sharing: Subsistence foods are widely distributed among households in a community through sharing, barter, and trade. According to Ikuta et al. (2016), 97 percent of Scammon Bay households reported receiving subsistence resources and 93 percent reported giving them away. In 2013, surveyed households gave away an average of 10 kinds of resources and received 11 kinds. Figure 3.21-47 shows the flow of wild foods into surveyed households from other households in Scammon Bay and other communities in Alaska.

Variability: Scammon Bay households experienced a below-average Chinook salmon harvest in 2013. This likely occurred due to management agencies' efforts to conserve Chinook salmon in the Yukon River fishery. In recent years, these conservation measures have curtailed subsistence fishing, particularly early in the salmon fishing season when Scammon Bay residents have historically targeted Chinook and summer chum salmon (Ikuta et al. 2016).

Ikuta et al. (2016) asked Scammon Bay residents if they used more, less, or about the same amount of subsistence resources in 2013 as in the past 5 years. A majority of Scammon Bay households (64 percent) reported using less Chinook salmon in 2013 compared to recent years. Over half of surveyed households used about the same amount of land mammals (55 percent of households), vegetation (54 percent), and marine mammals (52 percent) compared to recent years. A plurality of Scammon Bay households (47 percent of households) used about the same amount of birds and eggs in 2013 as in recent years.


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
Unalakleet
Stebbins
Saint Michael
Choolunawick
Kotlik
Bill Moore's Slough
Emmonak
Hamilton
Alakanuk
Sheldon Point
Nunam Iqua
Grayling
Anvik
Shageluk
Iditarod
Flat
Donlin Gold Project Site
Ophir
Medfra
Nikolai
Takotna
McGrath
175
200
225
250
275
300
Holy Cross
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Scammon Bay
Marshall
Paimiut
Hooper Bay
Chevak
Russian Mission
Ohogamiut
Crooked Creek
Georgetown
Red Devil
Stony River
Sleetmute
Upper Kalskag
Aniak
Chuathbaluk
Napaimute
Lower Kalskag
Lime Village
Newtok
Mertarvik
Tuluksak
Kasigluk
Nunapitchuk
Akiachak
Akiak
Bethel
Atmautluak
Oscarville
Kwethluk
Napaskiak
Napakiak
Tununak
Toksook Bay
Nightmute
Umkumiute
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Goodnews Bay
Platinum
Twin Hills
Togiak
Manokotak
0
50
100
Miles
All Resources Search and Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Data Source: Ikuta et al. 2016
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, SCAMMON BAY, 2013
JANUARY 2018
FIGURE 3.21-46



LEGEND

	Age of household head (years)			
	< 40	40 to 59	> 59	Unknown
Couple head	□	■	■	□
Single female head	▽	▼	▼	▽
Single male head	△	▲	▲	△

SYMBOLS are scaled by households' total subsistence harvests (in edible pounds). Surveyed households with many sources of goods and services appear near the center of the figure. Households with fewer sources appear around the edges.

Flows of wild foods from source harvesting and processing households to consuming households, as reported by consuming (surveyed) households

Household not surveyed

Household in other community

LINES are scaled by the number of resources harvested and processed by other households for surveyed households. Arrows point from source households to surveyed households. A household's production for itself is not shown.

Data Source: Ikuta et al. 2016

DONLIN GOLD

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WILD FOOD HARVESTING AND PROCESSING NETWORK, SCAMMON BAY, 2013

JULY 2017

FIGURE 3.21-47

3.21.5.8 SUBSISTENCE HARVEST PATTERNS: MOUTH OF THE YUKON SUBREGION

Communities located around the mouth of the Yukon River include the predominantly Yup'ik communities of Nunum Iqua, Alakanuk, Emmonak, Kotlik, Chuloonawick, Bill Moore's Slough, and Hamilton. Chuloonawick, Bill Moore's Slough, and Hamilton have no resident populations. Subsistence harvests in Lower Yukon communities involve a high reliance on fish, marine mammals, particularly seals, and moose. Harvest data for four communities shows per capita harvests from 482 pounds for Emmonak to 1,393 pounds for Nunum Iqua (Table 3.21-17). No subsistence harvest data are available for Chuloonawick, Bill Moore's Slough, and Hamilton. Emmonak was selected as the example community for the Mouth of the Yukon sub-region. Research in Emmonak was conducted in 2009.

Table 3.21-17: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Mouth of the Yukon Subregion Communities

	Nunum Iqua[1]	Alakanuk[1]	Emmonak	Kotlik[1]
Reference Year	**1980**	**1980**	**2008**	**1980**
All Resources	**1,393.45**	**725.02**	**481.83**	**502.60**
Marine Mammals	**209.22**	**126.61**	**54.94**	**100.85**
Seals	159.22	85.32	30.15	78.51
Walrus	0.00	4.03	0.00	0.00
Whales	50.00	35.25	24.79	22.34
Large Land Mammals	**43.57**	**41.15**	**122.89**	**34.68**
Black bear	0.00	0.00	0.00	0.00
Brown bear	0.00	0.00	0.00	0.00
Caribou	9.52	0.00	0.00	4.26
Moose	34.05	41.15	122.89	30.43
Small Land Mammals	**16.08**	**27.89**	**3.07**	**32.27**
Beaver	2.86	4.21	1.66	3.99
Fox	0.00	0.00	0.00	0.00
Hares	6.49	16.37	1.27	16.57
River otter	1.43	0.58	0.10	0.73
Lynx	0.00	0.00	0.03	0.00
Marten	0.00	0.00	0.00	0.00
Mink	0.00	0.00	0.00	0.00
Muskrat	5.30	6.73	0.02	10.98
Porcupine	--	--	0.01	--
Fishes	**1,090.11**	**476.83**	**274.70**	**295.19**
Salmon	671.61	197.57	191.52	144.09

Table 3.21-17: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Mouth of the Yukon Subregion Communities

	Nunum Iqua[1]	Alakanuk[1]	Emmonak	Kotlik[1]
Reference Year	**1980**	**1980**	**2008**	**1980**
Non-salmon	488.50	279.65	83.18	151.17
Marine Invertebrates	**0.00**	**0.00**	**0.15**	**0.00**
Birds and Eggs	**34.48**	**52.54**	**14.88**	**39.61**
Crane	4.52	5.76	1.37	5.32
Ducks	5.64	6.40	1.73	4.88
Geese	15.83	21.69	4.90	21.38
Shorebirds	0.00	0.00	0.00	0.00
Swans	4.28	10.93	2.83	3.94
Upland birds	4.19	7.76	3.70	4.09
Birds eggs	--	--	0.36	--
Vegetation	**--**	**--**	**11.19**	**--**

Notes:
Populations used in per capita harvest calculations – Nunum Iqua: 138; Alakanuk: 595; Emmonak: 788; Kotlik: 376;
1 The data reflects the per capita harvests of 7 households in Nunum Iqua, 21 in Alakanuk and 14 in Kotlik.
Source: ADF&G 2015d.

3.21.5.8.1 EMMONAK

Emmonak is a Yup'ik community located 12 miles upstream of the Bering Sea coast on the north bank of Kwiguk Pass of the Yukon River, approximately 120 miles from Bethel. In 2008, the population was estimated at 788 people. In 2009, researchers from the Alaska Department of Fish and Game surveyed 109 of 179 households in Emmonak. Expanding for the unsurveyed households, results of the survey show that residents of Emmonak harvested an estimated 379,803 pounds of wild foods with an average household harvest of 2,121 pounds. The average household income was $42,934 (Fall et al. 2012).

Species harvested and used: Emmonak households used an average of 22 different subsistence resources in 2008. One hundred percent of Emmonak households reported using a subsistence resource; and 94 percent reported harvesting a resource. The most widely used resource category was fish (98 percent). Other widely used resources included land mammals (97 percent), vegetation (95 percent), birds and eggs (87 percent), and marine mammals (82 percent). Vegetation was the most widely harvested resource category, followed by fish, birds and eggs, land mammals, and marine mammals (Fall et al. 2012). Percentages of Emmonak households using, harvesting, giving, and receiving specific subsistence resources are shown in Table 3.21-18.

The 2008 subsistence harvest in Emmonak was dominated by chum salmon and moose which each accounted 26 percent of the edible harvest, by weight. Fish and marine mammal species rounded out the rest of the top ten subsistence resources by edible weight: Chinook salmon (8 percent of the harvest), sheefish (6 percent), bearded seal (5 percent), beluga whale (5 percent),

coho salmon (4 percent), burbot (2 percent), northern pike (2 percent), and broad whitefish (1 percent). These ten species comprised an estimated 85 percent of the edible weight of the 2013 subsistence harvest in Emmonak (Figure 3.21-48) (Fall et al. 2012).

Table 3.21-18: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Emmonak, 2008

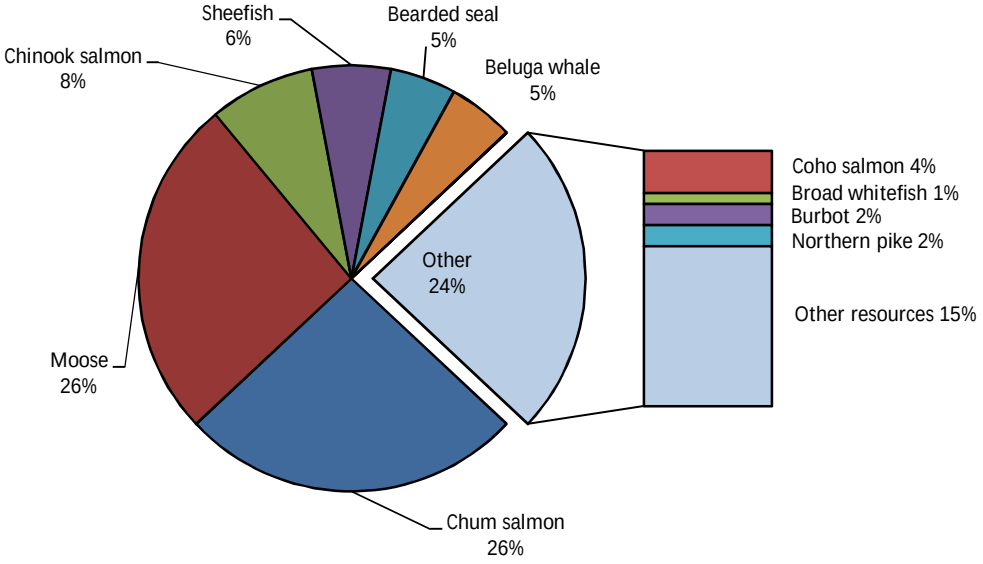
	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
All Resources	**100.0**	**93.6**	**84.4**	**96.3**
Salmon	**96.3**	**70.6**	**47.7**	**74.3**
Chinook	89.0	52.3	34.9	65.1
Chum	90.8	67.0	41.3	57.8
Coho	55.0	37.6	20.2	32.1
Sockeye	11.0	10.1	2.8	2.8
Pink	22.0	19.3	9.2	8.3
Non-Salmon Fishes	**89.0**	**69.7**	**49.5**	**72.5**
Sheefish	69.7	49.5	27.5	40.4
Burbot	53.2	32.1	24.8	26.6
Cisco	60.6	45.0	28.4	29.4
Northern pike	58.7	47.7	29.4	21.1
Land Mammals	**97.2**	**67.9**	**57.8**	**76.1**
Black bear	0.0	0.0	0.0	0.0
Caribou	7.3	0.0	0.9	7.3
Moose	95.4	60.6	52.3	73.4
Beaver	6.4	6.4	1.8	1.8
Hares	31.2	25.7	18.3	10.1
Muskrat	1.8	1.8	0.9	0.9
Marine Mammals	**81.7**	**45.0**	**47.7**	**64.2**
Beluga whale	45.9	13.8	18.3	37.6
Seals	79.8	42.2	42.2	55.0
Marine Invertebrates	**4.6**	**2.8**	**0.9**	**1.8**
Birds and Eggs	**87.2**	**73.4**	**54.1**	**54.1**
Ducks	62.4	54.1	24.8	17.4
Geese	83.5	70.6	38.5	37.6
Grouse and ptarmigan	64.2	55.0	30.3	23.9
Bird eggs	31.2	22.9	10.1	14.7
Vegetation	**94.5**	**89.0**	**50.5**	**58.7**
Berries	83.5	73.4	30.3	45.0

Table 3.21-18: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Emmonak, 2008

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
All Resources	**100.0**	**93.6**	**84.4**	**96.3**
Plants/greens/mushrooms	64.2	59.6	22.9	20.2
Wood	73.4	67.9	32.1	21.1

Notes:
Data based on surveys of 109 of 179 households in Emmonak
Source: Fall et al. 2012

Figure 3.21-48: Composition of Emmonak Subsistence Harvest by Estimated Edible Weight, 2008



Source: Fall et al. 2012

Seasonal round: In 2008 Emmonak hunters harvested beavers primarily in late spring and harvested a few beavers in August and September. Muskrats were harvested in October and trapping for other furbearers took place throughout the winter. Emmonak moose harvest took place in August, September, and late December through early January per ADF&G hunting regulations. In 2008, spring seal hunting, which takes place in leads and off pack ice, occurred during April. Hunting for seals, as well as for beluga whales, also took place from June through October. Emmonak residents typically target migratory birds, eggs, and several species of non-salmon fish during late spring. The first run of salmon occurs in late May or early June and salmon fishing continues through early September. During fall, Emmonak residents hunt migratory birds, fish for non-salmon fish species, and harvest berries (Fall et. al 2012).

Harvest areas: Residents of Emmonak reported a harvest area of 6,111 square miles in 2008. This area includes most of the waters and land in the Yukon Delta downstream from Mountain Village, near shore waters and ice in the Bering Sea (Figure 3.21-49). Outlying sites extended to the Kusilvak Mountains in the south and the Andreafsky River in the east. The coastal waters

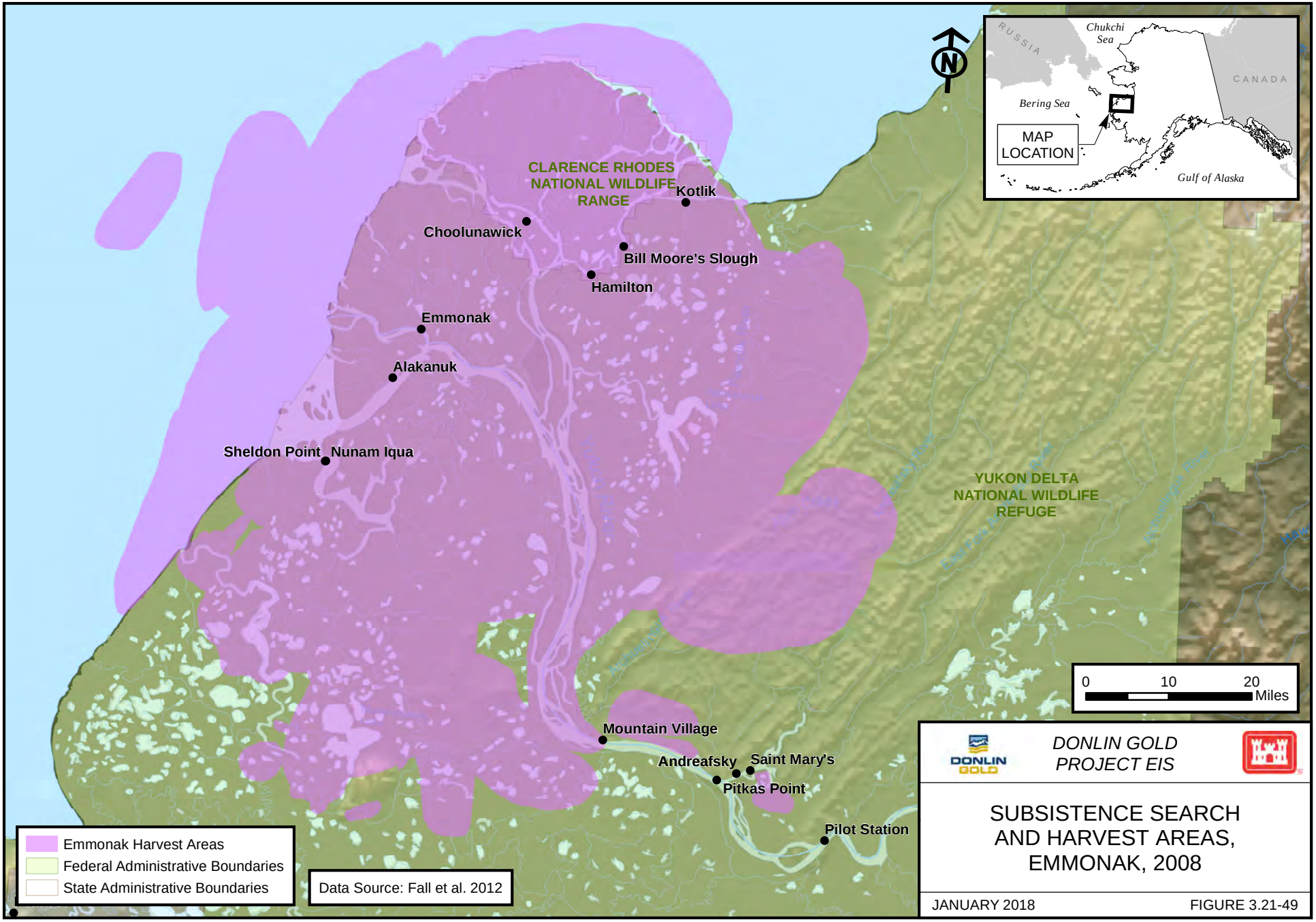
and numerous channels and tributaries of the Yukon River were used as harvest locations for fish, marine mammals, and waterfowl (Fall et al. 2012). Land bordering these waters was used to hunt moose and harvest greens and berries.

Sharing: As in other Alaska Native communities, in Emmonak sharing of wild foods is extensive. Wild foods are freely given to family members, friends, and community elders who need help providing for themselves. Eighty-four percent of households reported giving away resources and 96 percent said they received wild foods (Fall et al. 2012). There is no figure depicting subsistence the food sharing network for Emmonak, but data on households giving and receiving different subsistence resources are shown in Table 3.21-18.

Concerns: In 2008, Emmonak residents described how changing weather patterns (rainier summers and warmer winters) have altered how they hunt, as have improvements in technology, such as fast reliable snow machines that have allowed them to travel farther and faster. GPS [global positioning system] has become a substitute for in-depth knowledge of travel routes. Increasing costs have also led to a general decline in the level of participation in subsistence activities, which in turn affects levels of and transmission of traditional knowledge. They also noted the decline in salmon and subsequent regulatory restrictions which make it harder to harvest what they need (Fall et al. 2012).

3.21.5.9 SUBSISTENCE HARVEST PATTERNS: LOWER YUKON SUBREGION

The Lower Yukon River subregion includes Mountain Village, Marshall, Russian Mission, Pitka's Point, Ohogamiut, St. Mary's, and Pilot Station. There is no resident population of Ohogamiut. Residents of the lower Yukon communities have a long tradition of engaging in subsistence activities and many said that access to subsistence resources was essential to maintaining their cultural heritage, family, and community ties. Salmon, several species of non-salmon fish, and moose provide the bulk of the subsistence harvest in these communities. There are no subsistence harvest data for Pitka's Point, Ohogamiut, and Saint Mary's. As shown in Table 3.21-19, per capita harvests range from 158 pounds in Pilot Station to 393 pounds in Marshall. Russian Mission was selected as the example community from this subregion.



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SUBSISTENCE SEARCH AND HARVEST AREAS, EMMONAK, 2008

JANUARY 2018

FIGURE 3.21-49

Table 3.21-19: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Lower Yukon Subregion Communities

	Mountain Village	Pilot Station	Marshall	Russian Mission
Reference Year	**2010**	**2013**	**2010**	**2011**
All Resources	**264.54**	**158.3**	**393.23**	**329.18**
Marine Mammals	**14.53**	**8.6**	**5.90**	**3.23**
Seals	6.51	0.6	5.90	0.24
Walrus	0.00	0.0	0.00	0.00
Whale	8.02	8.0	0.00	2.99
Large Land Mammals	**60.60**	**61.0**	**71.95**	**107.46**
Black bear	0.00	1.7	2.70	3.21
Brown bear	0.00	0.0	0.00	0.00
Caribou	0.00	0.6	2.11	1.81
Dall sheep	0.00	0.0	0.00	0.00
Moose	60.60	58.7	67.14	102.45
Muskox	0.00	0.0	0.00	0.00
Small Land Mammals	**2.65**	**2.4**	**5.80**	**4.42**
Beaver	1.71	2.0	5.27	3.08
Red fox	0.00	0.0*	0.00	0.00
Snowshoe hare	0.85	0.2	0.41	1.03
River otter	0.00	<0.1	0.02	0.00
Lynx	0.08	<0.1	0.04	0.10
Marmot	0.00	0.0	0.00	0.00
Marten	0.00	0.0*	0.00	0.00
Mink	0.00	0.0*	0.00	0.09
Muskrat	0.01	<0.1	0.02	<0.01
Porcupine	0.01	0.1	0.04	0.12
Arctic ground squirrel	0.00	0.0*	0.00	0.00
Least weasel	0.00	0.0	0.00	0.00
Wolf	0.00	0.0*	0.00	0.00
Wolverine	0.00	0.0*	0.00	0.00
Fishes	**167.23**	**70.3**	**287.63**	**199.82**
Salmon	111.95	42.9	194.32	110.41
Non-salmon	55.28	27.4	93.32	89.40
Marine Invertebrates	**0.00**	**0.1**	**0.00**	**0.08**
Birds and Eggs	**9.57**	**9.4**	**13.72**	**9.47**
Sandhill crane	0.64	0.1	0.09	0.17
Ducks	1.00	1.5	1.76	1.64
Geese	3.70	4.3	4.87	3.51
Shorebirds	0.00	0.0	0.00	0.00
Tundra swan	1.90	3.0	5.46	1.20
Grouse and ptarmigan	2.15	0.5	1.26	2.85
Birds eggs	0.19	<0.1	0.29	0.10

Table 3.21-19: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Lower Yukon Subregion Communities

	Mountain Village	Pilot Station	Marshall	Russian Mission
Reference Year	**2010**	**2013**	**2010**	**2011**
Vegetation	**9.96**	**6.4**	**8.23**	**4.70**

Notes:
Populations used in per capita harvest calculations – Mountain Village : 785.4; Pilot Station: 626.4; Marshall: 341.8; Russian Mission: 401.9
* Small mammal species that were harvested, but are not typically eaten. Harvest weight was not calculated for species harvested but not eaten.

Source: Ikuta et al. 2014; Brown et al. 2015; ADF&G 2015d; Ikuta et al. 2016

3.21.5.9.1 RUSSIAN MISSION

Russian Mission is located on the west bank of the Yukon River in the Yukon-Kuskokwim Delta, 25 miles southeast of Marshall. The community lies 70 air miles northeast of Bethel and 376 miles west of Anchorage. In 2011, Russian Mission had an estimated population of 402 people. In 2012, researchers from ADF&G surveyed 46 of 79 households in Russian Mission. Expanding for the 33 unsurveyed households, Russian Mission's estimated total harvest of wild foods was 132,289 pounds or an average of 1,675 pounds per household. The mean household income was $51,352 (Ikuta et al. 2014).

Species Harvest and Use: Ninety-eight percent of Russian Mission households reported using and harvesting at least one wild resource in 2011. On average, households used 20 resources and harvested 16. Fish were the most widely used resource category (98 percent) followed by land mammals (96 percent), vegetation (89 percent), and birds and eggs (89 percent). In order, the most widely harvested categories of resources were vegetation, salmon, birds and eggs, non-salmon fish, and land mammals (Ikuta et al. 2014). Table 3.21-20 shows percentages of Russian Mission households using, harvesting, giving, and receiving specific resources.

Table 3.21-20: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Russian Mission, 2011

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
All Resources	**98**	**98**	**85**	**91**
Salmon	**96**	**85**	**44**	**50**
Chinook	85	70	28	37
Chum	80	70	33	15
Coho	48	35	13	22
Sockeye	4	4	2	2
Pink	2	2	0	0
Non-Salmon Fishes				
Sheefish	41	33	13	11
Humpback whitefish	52	35	24	28
Arctic lamprey	41	30	17	22

Table 3.21-20: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Russian Mission, 2011

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Northern pike	74	61	36	23
Land Mammals	**96**	**76**	**63**	**57**
Black bear	20	9	7	11
Caribou	11	4	4	7
Moose	91	59	52	53
Beaver	33	28	20	7
Hares	37	37	11	2
Muskrat	2	2	2	0
Marine Mammals	**61**	**4**	**7**	**59**
Beluga whale	26	2	7	24
Seals	61	2	2	59
Marine Invertebrates	**7**	**4**	**0**	**4**
Birds and Eggs	**89**	**78**	**39**	**59**
Ducks	74	63	26	28
Geese	80	63	26	43
Upland birds	61	61	13	9
Bird eggs	13	13	4	0
Vegetation	**89**	**89**	**46**	**39**
Berries	83	72	17	30
Plants/greens/mushrooms	63	59	26	9
Wood	78	74	24	13

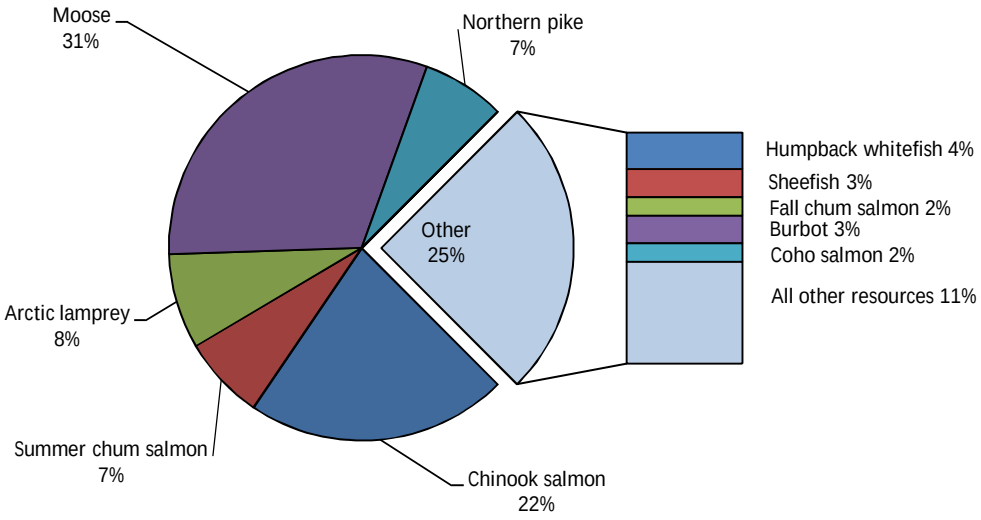
Notes:
Data based on surveys of 46 of 79 households in Russian Mission
Source: Ikuta et al. 2014

Fish composed over half of the community's total harvest with 61 percent coming from both salmon and non-salmon species. Chinook salmon made up 36 percent of the fish harvest. Moose composed just over 30 percent of the overall harvest followed by Arctic lamprey, Northern pike, and summer chum salmon. Other resources harvested by the community included various species of whitefish, coho salmon, burbot, and fall chum salmon (Figure 3.21-50). Marine mammals, black bear, and caribou each contributed less than 1 percent to the total harvest.

Seasonal round: Most migratory bird harvesting by Russian Mission residents is done in April and May. Egg harvesting follows in late May and early June. Spring is also the best time to harvest sheefish and bears. Residents begin harvesting salmon in late May or early June and continue until late September. Other fish species are harvested concurrently with salmon. Berry harvesting occurs in late summer and early fall. Residents harvest moose in the fall, particularly September. Whitefish, black bear, and Arctic lamprey are also harvested in fall. Fishing for non-salmon species continues into the winter months along with trapping of furbearers and hunting of small game birds (Ikuta et al. 2014).

Harvest areas: Households in Russian Mission reported a harvest area of 987 square miles in 2011 (Figure 3.21-51). The majority of salmon were harvested on the mainstem of the Yukon River. Harvest areas for non-salmon fish species and vegetation largely overlapped those of salmon along the Yukon River. Harvest areas for moose and black bear overlapped along the mainstem of the Yukon River. Black bear were also hunted along Paimiut Slough (Ikuta et al. 2014).

Figure 3.21-50: Composition of Russian Mission Subsistence Harvest by Estimated Edible Weight, 2011



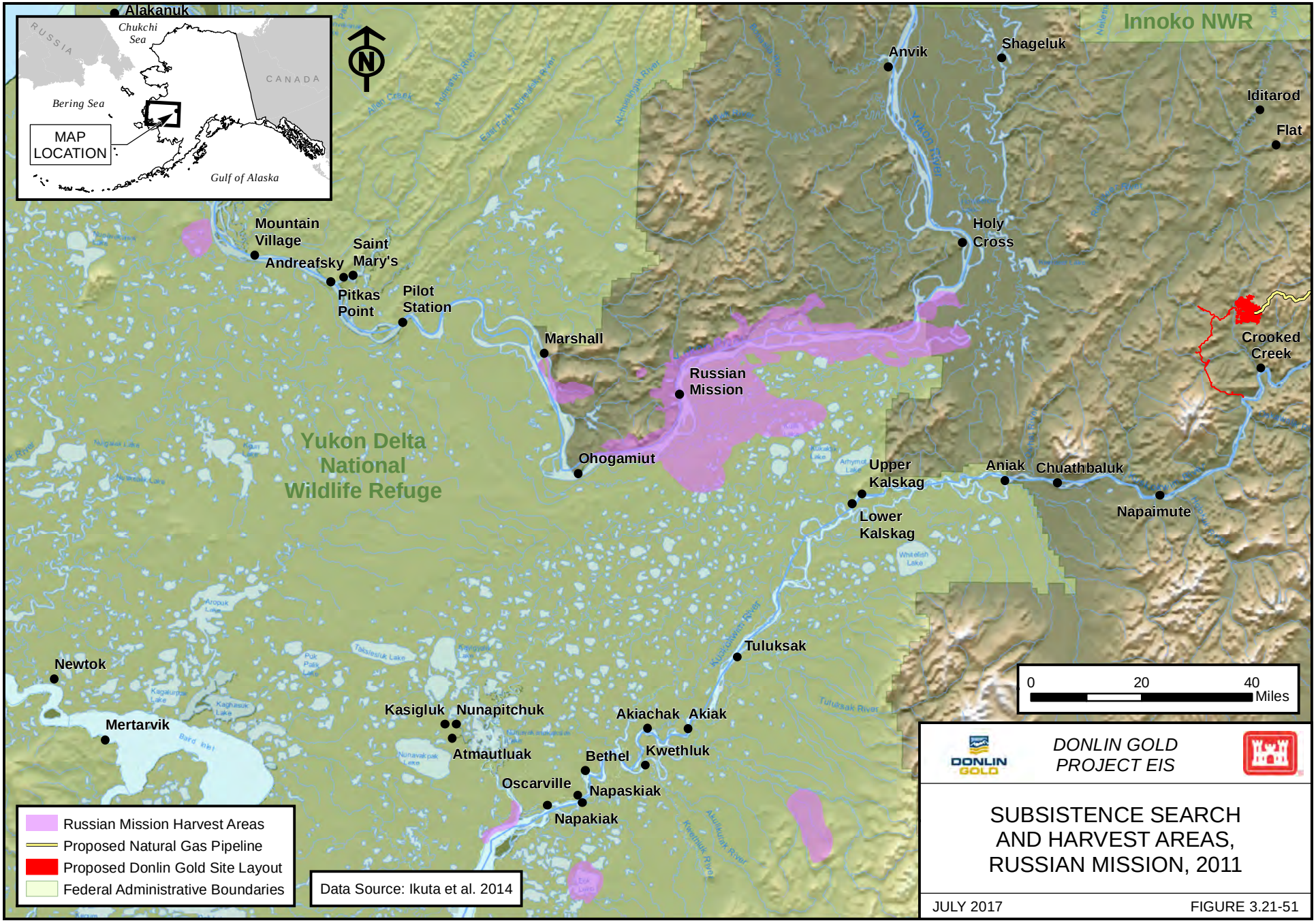
Source: Ikuta et al. 2014

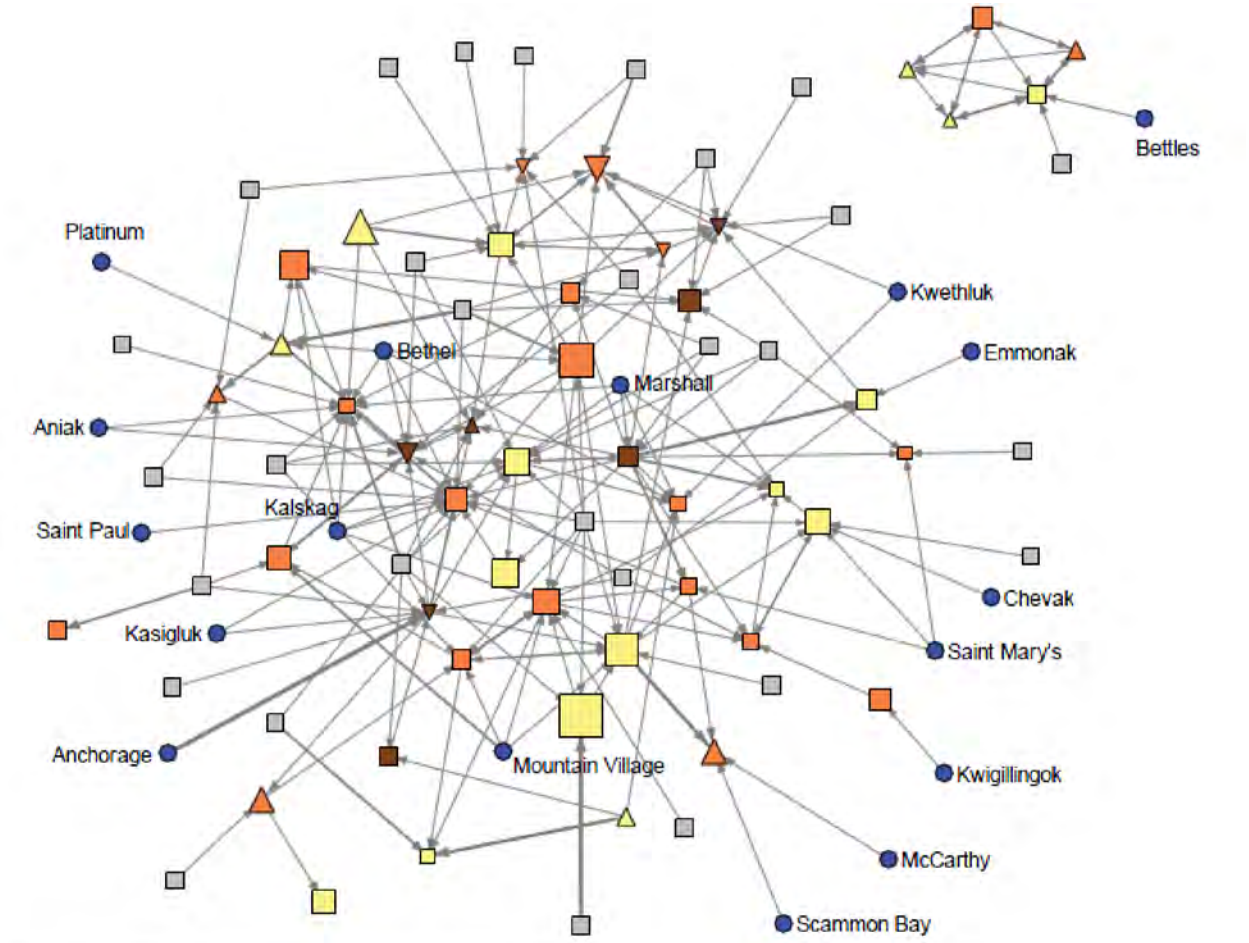
Sharing: In Russian Mission, as in other places in Alaska, traditional modes of sharing and exchange are a prominent feature of the community, with the redistribution of wild foods occurring along kinship and social connections. One resident explained the role of sharing in fostering security for households in need:

> What I mean is, you look at village life... everybody shares with everybody, you know, make sure nobody goes hungry, and if somebody does, you know all he has to do is come and visit and then, you then... right there, banquet (quoted in Ikuta et al. 2014).

A core group of households in Russian Mission harvested and served as the primary distributors of wild foods throughout the community. These are depicted as larger nodes in Figure 3.21-52 and were headed either by single adult males or mature or married couples with large families and substantial incomes. The figure shows that Russian Mission households had connections to 16 other communities around the state of Alaska (Ikuta et al. 2014).

Concerns: In 2011, researchers from ADF&G asked residents to assess their harvest in 2011 compared to the previous 5 years. For all resource categories except berries and greens, over 50 percent of the households that responded to the question, "Did you get enough resources?" said they did get enough in 2011. Although residents were generally able to meet their subsistence needs in 2011, they voiced concern over the availability of salmon in general and Chinook salmon in particular. Residents also commented on the effect of fuel prices on pursuing subsistence activities.


Alakanuk
Chukchi Sea
RUSSIA
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
N
Innoko NWR
Anvik
Shageluk
Iditarod
Flat
Holy Cross
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Marshall
Russian Mission
Crooked Creek
Yukon Delta National Wildlife Refuge
Ohogamiut
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Tuluksak
Newtok
Mertarvik
Kasigluk
Nunapitchuk
Atmautluak
Akiachak
Akiak
Bethel
Kwethluk
Oscarville
Napaskiak
Napakiak
0
20
40
Miles
Russian Mission Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Federal Administrative Boundaries
Data Source: Ikuta et al. 2014
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, RUSSIAN MISSION, 2011
JULY 2017
FIGURE 3.21-51



LEGEND

	Age of household head (years)			
	< 40	40 to 59	> 59	Unknown
Couple head	□	■	■	□
Single female head	▽	▼	▼	▽
Single male head	△	▲	▲	△

SYMBOLS are scaled by households' total subsistence harvests (in edible pounds). Surveyed households with many sources of goods and services appear near the center of the figure. Households with fewer sources appear around the edges.

Flows of wild foods from source harvesting and processing households to consuming households, as reported by consuming (surveyed) households

Household not surveyed

Household in another community

LINES are scaled by the number of resources harvested and processed by other households for surveyed households. Arrows point from source households to surveyed households. A household's production for itself is not shown.

Data Source: Ikuta et al. 2014

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, RUSSIAN MISSION, 2011

JULY 2017 FIGURE 3.21-52

3.21.5.10 SUBSISTENCE HARVEST PATTERNS: MIDDLE YUKON SUBREGION

Communities in the Middle Yukon subregion include the Athabascan communities of Holy Cross, Anvik, and Grayling on the Yukon River; and Shageluk, which is on the Innoko River. Subsistence harvests for the four communities range from a high of 634 pounds per person in Holy Cross to 246 pounds in Grayling (Table 3.21-21). Subsistence harvests in Middle Yukon communities involve a high reliance on large moose and salmon. Grayling was chosen as the highlighted community for this subregion.

Table 3.21-21: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Middle Yukon Subregion Communities

	Anvik	Grayling	Shageluk	Holy Cross
Reference Year	**2011**	**2011**	**2013**	**1990**
All Resources	**390.9**	**245.8**	**288.9**	**633.68**
Marine Mammals	**0.0**	**0.0**	**0.0**	**0.0**
Large Land Mammals	**90.0**	**58.7**	**73.7**	**321.8**
Black bear	0.0	0.6	2.6	0.00
Brown bear	0.0	0.0	0.0	5.40
Caribou	0.0	0.0	0.0	2.02
Dall sheep	0.0	0.0	0.0	0.00
Moose	90.0	58.1	71.1	314.42
Muskox	0.0	0.0	0.0	0.00
Small Land Mammals	**19.3**	**15.4**	**7.7**	**68.57**
Beaver	19.1	15.4	7.5	63.02
Red fox	0.0*	0.0*	0.0*	0.00
Hares	0.0*	0.0	0.1	5.55
River otter	0.0*	0.0	0.0*	0.00
Lynx	0.0*	0.0*	0.1	0.00
Marmot	0.0	0.0	0.0	0.00
Marten	0.0*	0.0*	0.0*	0.00
Mink	0.2	0.0*	0.0	0.00
Muskrat	0.0	0.0	0.1	0.00
Porcupine	0.1	0.0	0.0	0.00
Arctic ground squirrel	0.0	0.0	0.0	0.00
Fish	**266.6**	**159.2**	**187.6**	**202.11**
Salmon	231.8	121.9	69.6	121.18
Non-Salmon	34.8	37.4	118.0	80.93
Marine Invertebrates	**0.0**	**0.0**	**<0.1**	**0.00**
Birds and Eggs	**12.8**	**7.9**	**12.6**	**28.51**
Ducks	4.7	1.6	4.8	3.41
Geese	5.5	3.8	5.5	21.77
Tundra swan	0.0	0.1	0.9	0.04
Ptarmigan and grouse	2.6	2.4	1.2	3.29

Table 3.21-21: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Four Middle Yukon Subregion Communities

	Anvik	Grayling	Shageluk	Holy Cross
Reference Year	**2011**	**2011**	**2013**	**1990**
Bird eggs	0.0	0.0	0.0	0.00
Vegetation	**2.2**	**4.6**	**7.3**	**12.65**

Notes:
Populations used in per capita harvest calculations – Anvik: 88.0; Grayling: 212.0; Shageluk: 84.8; Holy Cross: 274
* Small mammal species that were harvested, but are not typically eaten. Harvest weight was not calculated for species harvested but not eaten.

Source: Ikuta et al. 2014; ADF&G 2015d; Ikuta et al. 2016

3.21.5.10.1 GRAYLING

Grayling is an Athabascan community located on the west bank of the Yukon River approximately 350 miles from the mouth of the Yukon. In 2012, the population was estimated at 212 people. Researchers from the Alaska Department of Fish and Game surveyed 41 of 55 households in the winter of 2012. Expanding for the 14 unsurveyed households, Grayling residents harvested an estimated 52,094 pounds of wild foods, with an average household harvest of 947 pounds. The average household income was $34,161 (Ikuta et al. 2014).

Species harvested and used: The most widely used subsistence resources were salmon, land mammals, non-salmon fish species, vegetation, and birds and eggs. The most widely harvested resource categories were vegetation, non-salmon fish, and salmon. A few households used or harvested marine mammals and invertebrates. More households reported using (98 percent) and harvesting (66 percent) Chinook salmon than any other fish species. Moose were the most widely used (98 percent) and harvested (39 percent) of all land mammals (Table 3.21-22). Slightly more households reported the use of moose than vegetation (93 percent).

Table 3.21-22: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Grayling, 2011

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
All Resources	**100**	**98**	**68**	**90**
Salmon	**100**	**68**	**42**	**54**
Chinook	98	66	32	49
Chum	59	37	29	27
Coho	24	17	7	7
Sockeye	7	7	5	0
Pink	0	0	0	0
Non-Salmon Fishes				
Sheefish	76	61	24	39
Broad whitefish	39	34	20	15

Table 3.21-22: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Grayling, 2011

	Percentage of Households			
	Using	**Harvesting**	**Giving Away**	**Receiving**
Humpback whitefish	32	22	12	12
Northern pike	29	24	10	7
Land Mammals	**98**	**49**	**46**	**76**
Black bear	7	2	2	7
Caribou	0	0	0	0
Moose	98	39	34	71
Beaver	37	22	15	20
Hares	0	0	0	0
Muskrat	2	0	0	2
Marine Mammals	**10**	**0**	**5**	**10**
Beluga whale	7	0	5	7
Seals	7	0	5	7
Marine Invertebrates	**5**	**0**	**0**	**5**
Birds and Eggs	**66**	**56**	**32**	**22**
Ducks	22	17	15	10
Geese	32	22	20	15
Upland birds	61	56	24	15
Bird eggs	0	0	0	0
Vegetation	**93**	**90**	**46**	**37**
Berries	71	68	24	22
Plants/greens/mushrooms	27	27	7	0
Wood	71	59	22	20

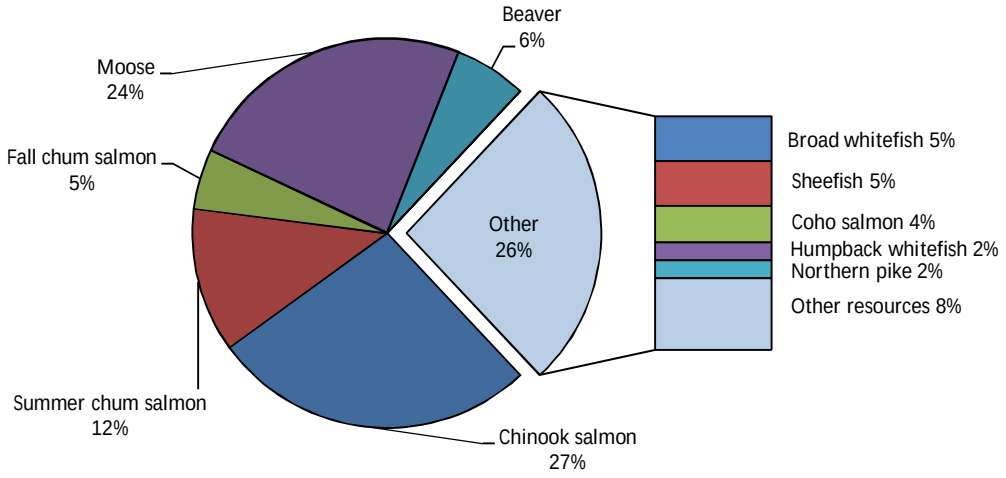
Notes:
Data based on surveys of 41 of 55 households in Grayling
Source: Ikuta et al. 2014

The top ten resources harvested, in terms of edible weight, were Chinook salmon, summer chum salmon, fall chum salmon, moose, beaver, broad whitefish, sheefish, coho salmon, humpback whitefish, and northern pike (Figure 3.21-53). Other species harvested by Grayling residents included Canada goose, spruce grouse, Arctic grayling, several types of berries, and black bear. The community did not report any harvest of caribou in 2011 (Ikuta et al. 2014).

Seasonal round: Grayling residents harvest migratory birds in spring and fall and collect eggs in spring. Summer months are occupied primarily with salmon fishing. In late summer and early fall Grayling residents harvest berries and hunt for moose. Trapping furbearers and fishing for non-salmon species occur in winter (Ikuta et al. 2014).

Harvest areas: Grayling residents reported a harvest area of 1,164 square miles in 2011. Much of the subsistence harvest activities pursued by Grayling residents occur along the river corridors (Ikuta et al. 2014) (Figure 3.21-54). The main search and harvest areas for salmon, non-salmon fish and vegetation are located upriver from Grayling on the Yukon River, along the Innoko River, and Shageluk Slough. Moose are hunted up and down the Yukon River from the village.

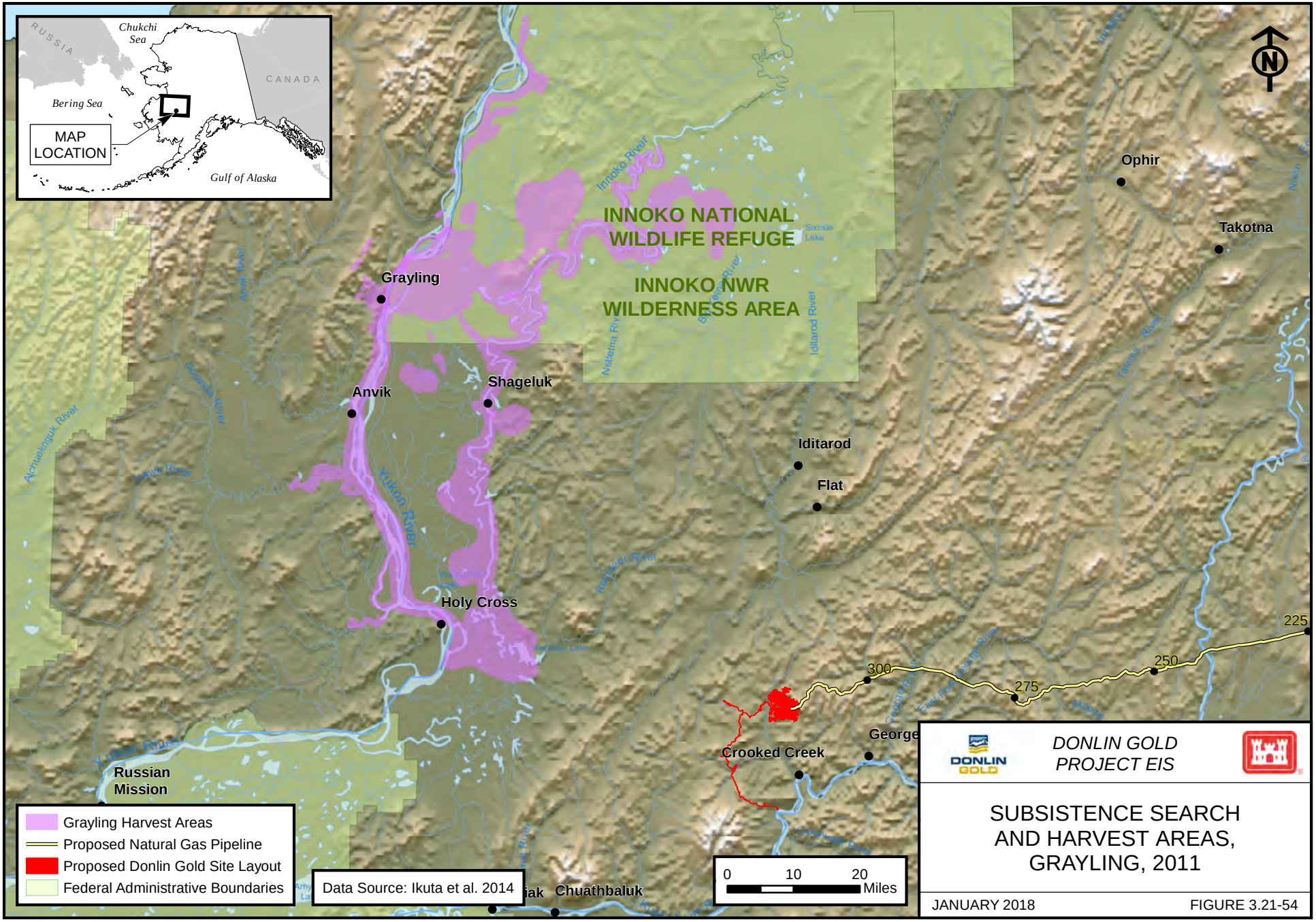
Figure 3.21-53: Composition of Grayling Subsistence Harvests by Estimated Edible Weight, 2011

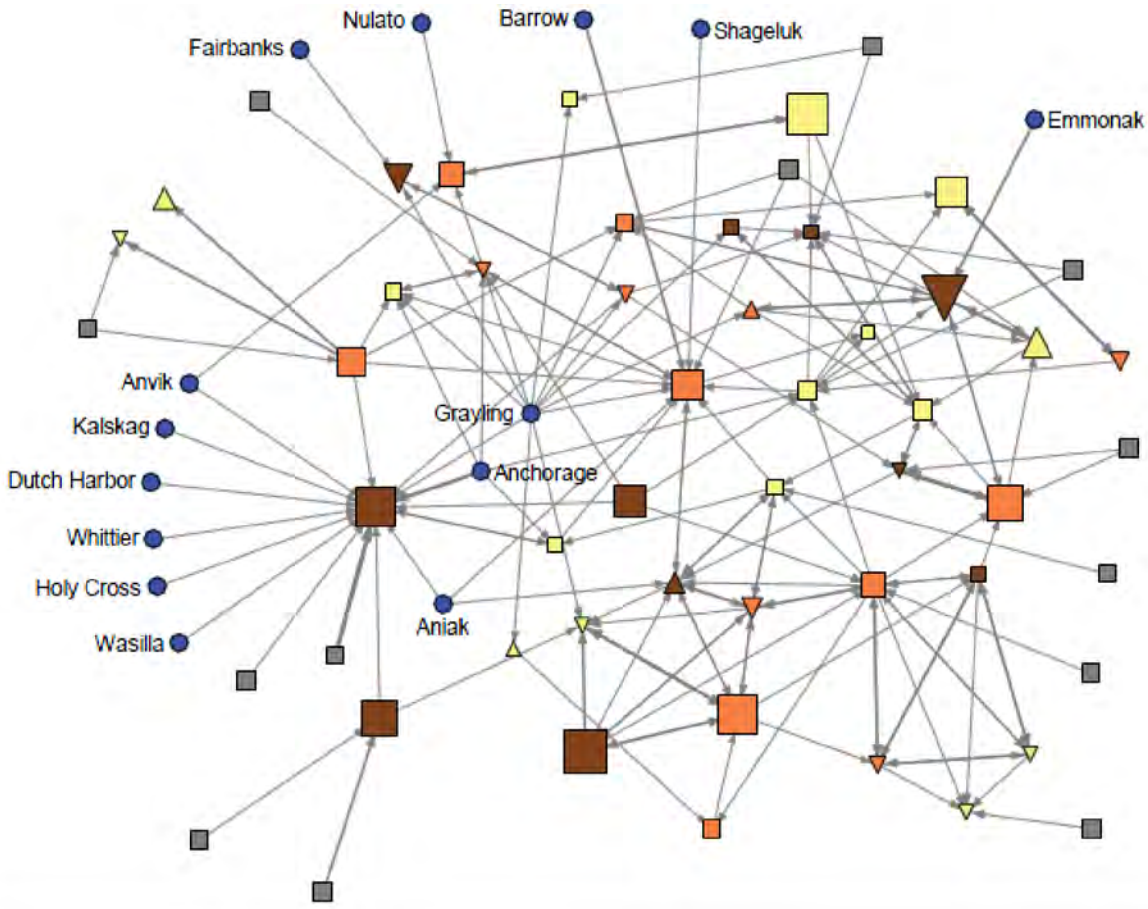


Source: Ikuta et al. 2014

Sharing: As in other Alaska Native communities, in Grayling sharing of wild foods is extensive and links the community to at least 13 other communities in Alaska. Figure 3.21-55 shows sharing networks within Grayling as well as outside the community during the study year 2011. The figure shows several high-harvesting households depicted as larger nodes. A married couple heads almost every one of these households. Every surveyed household in the village had at least one connection to another household (Ikuta et al. 2014).

Concerns: For four resource categories: salmon, non-salmon fish, land mammals, and birds and eggs, a majority of households that responded to the question, "Did you get enough resources?" said they did get enough in 2011. Although residents were generally able to meet their subsistence needs in 2011, over 60 percent of households interviewed said they used less salmon and less vegetation than in previous years. One reason for using less salmon was the restrictions placed on harvesting Chinook salmon (Ikuta et al. 2014).


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
INNOKO NATIONAL WILDLIFE REFUGE
INNOKO NWR WILDERNESS AREA
Innoko River
Grayling
Anvik
Shageluk
Holy Cross
Iditarod
Flat
Ophir
Takotna
Crooked Creek
George
Russian Mission
Chuathbaluk
Yukon River
Anvik River
Iditarod River
Tatlma River
Nixon
225
250
275
300
N
Grayling Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Federal Administrative Boundaries
Data Source: Ikuta et al. 2014
0 10 20 Miles
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, GRAYLING, 2011
JANUARY 2018
FIGURE 3.21-54



LEGEND

	Age of household head (years)			
	< 40	40 to 59	> 59	Unknown
Couple head	□	□	□	□
Single female head	▽	▽	▽	▽
Single male head	△	△	△	△

SYMBOLS are scaled by households' total subsistence harvests (in edible pounds). Surveyed households with many sources of goods and services appear near the center of the figure. Households with fewer sources appear around the edges.

Flows of wild foods from source harvesting and processing households to consuming households, as reported by consuming (surveyed) households

Household not surveyed

Household in another community

LINES are scaled by the number of resources harvested and processed by other households for surveyed households. Arrows point from source households to surveyed households. A household's production for itself is not shown.

Data Source: Ikuta et al. 2014

DONLIN GOLD

DONLIN GOLD PROJECT EIS

WILD FOOD HARVESTING AND PROCESSING NETWORK, GRAYLING, 2011

JULY 2017

FIGURE 3.21-55

3.21.5.11 SUBSISTENCE HARVEST PATTERNS: COOK INLET SUBREGION

The Cook Inlet subregion includes the communities of Skwentna, Tyonek, and Beluga. Comprehensive harvest data for Beluga was collected in 2006, updating baseline information first documented in the 1980s. During the August 1, 2005 through July 31, 2006 study year, Beluga residents harvested 204 pounds of edible subsistence resources per capita (Stanek et al. 2007). In 2013, researchers from the ADF&G, Division of Subsistence conducted a household survey in Skwentna and interviewed 86 percent of all year-round households on the previous year's subsistence harvest (Holen et al. 2014). Skwentna residents harvested 161 pounds of usable weight per person in 2012. Tyonek residents, surveyed in 2014, harvested 170 pounds of edible subsistence resources during 2013 (Jones et al. 2015). Table 3.21-23 shows per capita harvests of various subsistence resources by residents of the Cook Inlet subregion communities. Tyonek was selected as the example community to profile.

Table 3.21-23: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Three Cook Inlet Subregion Communities

	Tyonek	Beluga	Skwentna
Reference Year	**2013**	**2005-2006**	**2012**
All Resources	**169.9**	**204.0**	**161.2**
Marine Mammals	**2.5**	**0**	**0.0**
Harbor seal	2.5	0	0.0
Beluga whale	0.0	0	0.0
Large Land Mammals	**24.3**	**60.6**	**71.8**
Black bear	0.0	9.4	8.8
Brown bear	0.0	0	2.8
Caribou	0.0	0	0.0
Dall sheep	0.0	0	0.0
Deer	--	--	0.8
Moose	24.3	43.8	59.4
Muskox	--	7	--
Small Land Mammal	**1.0**	**0.1**	**1.4**
Beaver	0.5	0.0*	0.6
Coyote	0.0	0*	0.0*
Fox	0.0	0*	0.0*
Snowshoe hare	0.0	0.1	0.6
River otter	0.0	0*	0.0*
Lynx	0.0	0	0.0*
Marmot	0.0	0	0.0
Marten	0.0	0*	0.0*
Mink	0.0	0*	0.0
Muskrat	0.0	0*	0.0
Porcupine	0.4	0*	0.0
Squirrel	0.0	<0.1	0.2
Weasel	0.0	--	0.0*

Table 3.21-23: Estimated Per Capita Subsistence Harvests in Edible Weight (lbs.) for Three Cook Inlet Subregion Communities

	Tyonek	Beluga	Skwentna
Reference Year	**2013**	**2005-2006**	**2012**
Wolf	0.0	0*	0.0
Wolverine	0.0	0	0.0*
Fishes	**130.6**	**123.7**	**73.7**
Salmon	117.5	87.6	54.3
Non-salmon	13.1	36.2	19.5
Marine Invertebrates	**0.9**	**1.7**	**2.1**
Birds and Eggs	**1.2**	**6.7**	**4.2**
Crane	0.0	0.5	0.3
Ducks	0.5	0.9	1.1
Geese	0.3	0.7	<0.1
Swans	0.0	--	0.0
Upland birds	0.3	4.7	2.8
Bird eggs	<0.1	0	0.0
Vegetation	**9.5**	**11.1**	**7.9**

Notes:
Populations used in per capita harvest calculations – Tyonek: 143; Beluga: 21; Skwentna: 62
Source: Stanek et al. 2007; Holen et al. 2014; Jones et al. 2015

3.21.5.11.1 TYONEK

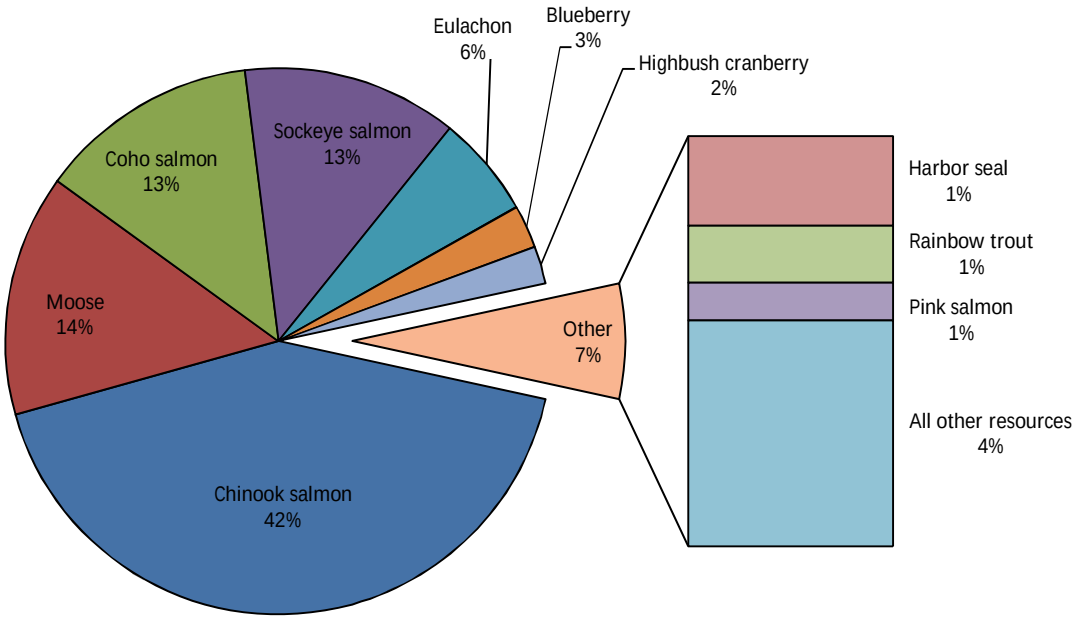
Tyonek is a Dena'ina Athabascan community that lies on a bluff on the northwest shore of Cook Inlet, 43 miles southwest of Anchorage. Tyonek is the largest community in the subregion and had an estimated population of 143 people during 2013 (Jones et al. 2015). In January 2014, researchers from ADF&G, Division of Subsistence conducted a household survey in Tyonek on the harvests and uses of wild resources during the 2013 calendar year.

Researchers from the ADF&G surveyed 49 of 63 households in Tyonek. During the study year, Tyonek residents harvested an estimated 24,249 edible pounds of wild resources; an average of 385 pounds per household, or 170 pounds per person. The mean household income was $36,727 (Jones et al. 2015).

Species Harvest and Use: Salmon provided 70 percent of the total usable harvest weight, while large mammals provided 18 percent, and non-salmon fish species 5 percent (Figure 3.21-56).

All Tyonek households used and harvested at least one subsistence resource in 2013. Edible plants (91 percent), Chinook salmon (85 percent), and moose (83 percent) were the most widely used resources, followed by non-salmon fish species (57 percent), and marine mammals (47 percent). In terms of harvest, a large majority of households harvested Chinook salmon (72 percent) and edible plants (92 percent), but far fewer households harvested non-salmon fish (28 percent), moose (19 percent), or sea mammals (4 percent). No one reported a harvest of caribou (Table 3.21-24).

Figure 3.21-56: Composition of Tyonek Subsistence Harvest by Estimated Edible Weight, 2013



Source: Jones et al. 2015

Table 3.21-24: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Tyonek, 2013

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
All Resources	**100.0**	**100.0**	**77.6**	**85.7**
Salmon	**89.8**	**81.6**	**59.2**	**49.0**
Chinook	85.7	75.5	55.1	40.8
Chum	8.2	8.2	2.0	0.0
Coho	65.3	59.2	40.8	32.7
Sockeye	46.9	42.9	26.5	22.4
Pink	12.2	12.2	8.2	0.0
Unknown salmon	2.0	2.0	0.0	0.0
Non-Salmon Fishes	**53.1**	**40.8**	**22.4**	**34.7**
Rainbow trout	28.6	24.5	10.2	10.2
Eulachon	30.6	18.4	16.7	20.4
Large Land Mammals	**73.5**	**12.2**	**24.5**	**67.3**
Black bear	0.0	0.0	0.0	0.0
Caribou	2.0	0.0	0.0	2.0
Moose	73.5	12.2	24.5	67.3
Small Land Mammals	**12.2**	**6.1**	**4.1**	**6.1**
Beaver	8.2	4.1	0.0	4.1

Table 3.21-24: Estimated Use, Harvest, and Sharing of Subsistence Resources by Category and Selected Species, Tyonek, 2013

	Percentage of Households			
	Using	**Harvesting**	**Giving away**	**Receiving**
Snowshoe hare	2.0	2.0	0.0	0.0
Porcupine	6.1	4.1	4.1	2.0
Marine Mammals	**14.3**	**6.1**	**6.1**	**14.3**
Beluga whale	10.2	0.0	2.0	10.2
Harbor seal	6.1	6.1	6.1	14.3
Marine Invertebrates	**16.3**	**10.2**	**4.1**	**8.2**
Birds and Eggs	**32.7**	**28.6**	**16.3**	**8.2**
Mallard	8.2	6.1	2.0	4.1
Northern pintail	12.2	10.2	6.1	2.0
Spruce grouse	14.3	14.3	6.1	2.0
Bird eggs	2.0	2.0	2.0	0.0
Vegetation	**89.8**	**83.7**	**44.9**	**46.9**
Blueberry	61.2	59.2	24.5	18.4
Highbush cranberry	49.0	44.9	22.4	14.3
Wood	79.6	71.4	10.4	30.6

Notes:
Data based on surveys of 49 of 63 households in Tyonek

Source: Jones et al. 2015

Tyonek's salmon harvest was composed largely of Chinook and coho salmon. Sockeye were taken in small quantities, usually incidental to the harvest of Chinook. Most salmon were harvested with subsistence setnets. Some salmon were also harvested with rod and reel, which typically occurred during fall hunting trips.

Seasonal Round: Tyonek residents harvest eulachon in April and May. The federal subsistence waterfowl season runs from April 2 to May 31. Subsistence-use setnet fishing for Chinook salmon begins May 15. In the spring, Tyonek residents dig for clams and harvest edible greens. Tyonek residents harvest salmon in the summer and fish for Dolly Varden and rainbow trout in July. Berries and greens are harvested in late summer. During fall, Tyonek residents harvest moose, upland game birds, and waterfowl. Tyonek residents fish for non-salmon species, hunt moose and ptarmigan, harvest firewood, and trap beaver during the winter months.

Harvest Areas: Tyonek residents reported using almost 254 square miles to search for and harvest subsistence resources during 2013. Residents fished for salmon in Cook Inlet along the beach from Granite Point north to the mouth of the Chuitna River. Areas used by Tyonek residents to hunt large land mammals extend from north of the Beluga River to Trading Bay Flats and along the McArthur River. Moose hunting area shifted between the fall and winter seasons as the ground froze and opened areas up to travel. Marine mammals were hunted around the mouths of Beluga River, Nikolai Creek, and MacArthur River. Edible plants and wood were harvested from north of Chuitna River to east of the Trading Bay Flats. Marine invertebrates were harvested at Clam Gulch on the east side of Cook Inlet. Figure 3.21-57 shows the subsistence search and harvest areas used by Tyonek residents in 2013.

Sharing: Sharing of resources was widespread in Tyonek. In 2013, 86 percent of households reported receiving a resource and 78 percent said they gave resources to other households (Jones et al. 2015). Residents noted that the sharing of moose products including the meat, internal organs, and the nose and tongue, is an integral part of Tyonek culture. Over 67 percent of households received moose during the study year. There is no figure to depict wild food harvesting and processing networks.

Variability: In 1983-84, Tyonek residents harvested 260 pounds per capita compared to 217 pounds in 2005-06 and 170 pounds per capita in 2013 (Fall et al. 1984; Stanek et al. 2007; Jones et al. 2015). Most of the difference was due to decrease in the harvest of salmon (187 pounds per capita in 1983-84, 151 pounds per capita in 2005-06, and 118 pounds per capita in 2013) and large land mammals (55 pounds per capita in 1983-84, 40 pounds per capita in 2005-06, and 24 pounds per capita in 2013). Tyonek residents also had lower harvests of marine mammals and marine invertebrates in 2013 than in 2005-06. On the other hand, Tyonek residents did report higher per capita harvests of non-salmon fish and edible plants in 2013 and 2005-06 than in 1983-84 (Fall et al. 1984; Stanek et al. 2007; Jones et al. 2015).

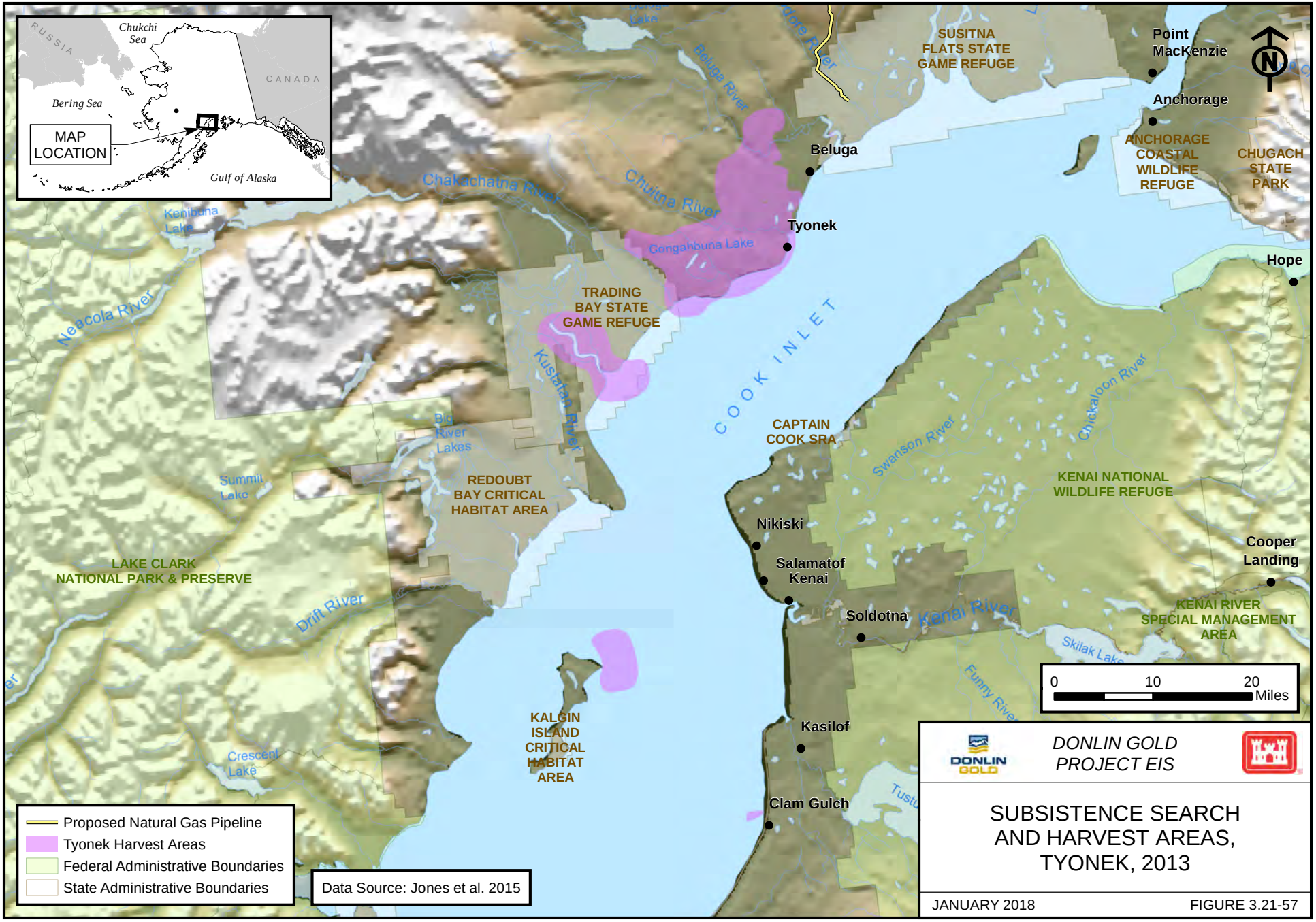
In 2005-06, Tyonek residents said that local moose population had been in decline and there was increased competition from urban residents. They also noted that because of warmer weather moose remained at higher elevations making it difficult and costly to hunt. Residents also said that the price of gasoline had affected their ability to hunt the local road system (Stanek et al. 2007).

Respect for subsistence resources, especially moose, was an overarching theme in the concerns related by Tyonek residents. In relation to possible development in the area, Tyonek residents said that if large numbers of non-locals settle in the area to work in a proposed coal mine they may not show respect for the animals. They feared that non-locals would show disrespect by killing animals indiscriminately and not use the meat. Residents also worried that they would be displaced from traditional hunting areas.

3.21.5.12 CLIMATE CHANGE

Climate change has recently affected, and will continue to affect, temperature and precipitation regimes, timing of breakup and freezeup, river water flow, ice thickness in winter, wetlands, vegetation, fish and wildlife habitats and populations (see Section 3.26, Climate Change).

Subsistence resource populations are subject to a large degree of year-to-year variations, with an important degree of uncertainty as to the causes. Climate change is likely a contributing factor to recent declines in moose populations in GMU 19A and Kuskokwim River chinook runs. However, with the current state of knowledge, it is not possible to definitively identify the degree to which climate change, among many other factors, is causing the declines.


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
Beluga River
Chakachatna River
Chuitna River
Kenibuna Lake
Gongahbuna Lake
Neacola River
Kustatan River
Big River Lakes
Summit Lake
Drift River
Crescent Lake
Beluga
Tyonek
SUSITNA FLATS STATE GAME REFUGE
TRADING BAY STATE GAME REFUGE
REDOUBT BAY CRITICAL HABITAT AREA
KALGIN ISLAND CRITICAL HABITAT AREA
LAKE CLARK NATIONAL PARK & PRESERVE
COOK INLET
CAPTAIN COOK SRA
Swanson River
Chickaloon River
KENAI NATIONAL WILDLIFE REFUGE
Nikiski
Salamatof
Kenai
Soldotna
Kenai River
Skilak Lake
Funny River
Kasilof
Clam Gulch
Tustumena Lake
Point MacKenzie
Anchorage
ANCHORAGE COASTAL WILDLIFE REFUGE
CHUGACH STATE PARK
Hope
Cooper Landing
KENAI RIVER SPECIAL MANAGEMENT AREA
N
0 10 20 Miles
Proposed Natural Gas Pipeline
Tyonek Harvest Areas
Federal Administrative Boundaries
State Administrative Boundaries
Data Source: Jones et al. 2015
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SUBSISTENCE SEARCH AND HARVEST AREAS, TYONEK, 2013
JANUARY 2018
FIGURE 3.21-57

One of the most important recent and ongoing effects on subsistence uses due to climate change is less predictable ice thickness and more widespread and frequent instance of open water in the winter. For the Kuskokwim River area, the ANTHC Local Observer Network includes observations for the Kuskokwim River of recent low snow years, early breakup, thin river ice, and open water in winter, which may be related to climate warming. For example, observations in Bethel in 2014 documented a mild winter, very low snow conditions, and thin river ice in the months of January through April. These changes and uncertainties made for very dangerous winter ice-travel conditions and may have reduced subsistence travel. Such conditions and restrictions on subsistence should be expected in the future.

3.21.6 ENVIRONMENTAL CONSEQUENCES

Throughout the Scoping meetings and meetings on the Draft EIS, Alaska Native residents of the EIS Analysis Area emphasized their desire to protect and maintain their cultural traditions and subsistence way of life. This section examines the potential impacts of project activities at the Mine Site, Transportation Corridor, and the Pipeline on the subsistence patterns of residents in the EIS Analysis Area communities. In addition, the Donlin Gold Project is evaluated through the phases of Construction, Operations, and Closure, each of which may have different degrees of impact. Detailed treatment of each phase is provided, when the environmental consequences are different. If the effects are similar between phases, they may be treated together in a discussion.

As described in Section 3.21.5, subsistence patterns include harvests of a wide diversity of species taken in the seasonal round, subsistence use areas of community-based groups, and sharing practices. Examples of subsistence impacts could include reductions in subsistence resource abundance, reduced access, increased competition, and change in income available to support subsistence activities.

As described in Section 3.0.2.1, impacts to subsistence uses can result from interrelated and cascading effects among many resources. For example, impacts to air quality, water flow and quality, and vegetation may affect habitat quality and fish and wildlife populations, resulting in turn in changes in subsistence use patterns. Perceptions and concerns regarding potential impacts on the quality of subsistence resources can also result in changes in subsistence use patterns.

The following section identifies potential types of impacts to subsistence focusing on the experience of Subject Matter Experts with resource development projects and the NEPA process, Section 810 of ANILCA, Alaska subsistence literature, and comments from local residents (Section 3.21.6.1). The subsections that follow analyze and estimate the likely levels of impacts associated with each of the project alternatives. The intensity, duration, geographic extent, and context of impacts are assessed for the three project components (Mine Site, Transportation Corridor, and Pipeline) and phases. Where impacts differ among the phases of Construction, Operations, and Closure, descriptions are provided.

3.21.6.1 ANALYZING IMPACTS TO SUBSISTENCE

In addition to the guidance provided under NEPA and the Council on Environmental Quality in implementing NEPA, and the experience of Subject Matter Experts with resource development projects and the NEPA process, there are some additional considerations when

assessing the potential impacts to subsistence from the Donlin Gold Project. Some of these reflect regulatory requirements and comments made during the Scoping process and the public comment period on the Draft EIS. These are described below.

3.21.6.1.1 POTENTIAL IMPACTS IDENTIFIED UNDER ANILCA SECTION 810

Within ANILCA Title VIII, the federal statute protecting subsistence practices of rural Alaska, Section 810 requires a review of the potential for federal land management activities to "significantly restrict" subsistence uses and needs. As defined in ANILCA Section 803,

> … the term "subsistence uses" means the customary and traditional uses by rural Alaska residents of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade. For the purposes of this section, the term—
>
> (1) "family" means all persons related by blood, marriage, or adoption, or any person living within the household on a permanent basis; and
>
> (2) "barter" means the exchange of fish or wildlife or their parts, taken for subsistence uses—
>
> (A) for other fish or game or their parts; or
>
> (B) for other food or for nonedible items other than money if the exchange is of limited and noncommercial nature.

Because the Donlin Gold Project requires a BLM lease for a portion of the Pipeline ROW, the BLM is a cooperating agency in the preparation of this EIS, which is intended to meet BLM requirements for NEPA compliance. In addition, the BLM has prepared a formal ANILCA Section 810 analysis for all related actions that are connected to the Pipeline ROW authorization, including the river and road transportation routes, and mine site operation components of the project.

This Section 810 analysis is found in Appendix N.

ANILCA Section 810 implementation policies in the Department of the Interior have been developed and revised over the years.

The BLM has framed these types of potential impacts in Instruction Memorandum No, AK-2011-008 as:

- A reduction in the abundance of harvestable resources used for subsistence purposes. This, for example, may include fish, wildlife, edible flora, house logs, fuel wood, drinking water, etc. Forces that might cause a reduction include adverse impacts on habitat, direct impacts on the resource, increased harvest and increased competition from non-subsistence harvesters.
- A reduction in the availability of resources caused by an alteration in their distribution, migration, or location.
- A limitation on the access of subsistence users to harvestable resources. Such an evaluation includes only physical and legal barriers.

The analysis of potential impacts to subsistence in this EIS incorporates the ANILCA Section 810 Guidelines. The ANILCA Section 810 framework of analysis differs from the NEPA framework, and may result in differing conclusions. The primary differences are:

1) how NEPA and ANILCA define 'may significantly affect'.
2) The ANILCA Section 810 focuses on a three factors: significant reduction in abundance of harvestable resources, reduction in availability of resources, and limitation on access to resources. The NEPA analysis assesses both adverse and beneficial impacts to subsistence, including how wage employment from proposed projects have historically provided monetary support to pursuit of subsistence activities
3) NEPA analyses also include a more broad inclusion of context and intensity, which ANILCA may not.
4) NEPA also has different guidelines when assessing and incorporating mitigation into impacts analysis and Records of Decisions than does ANILCA. Therefore, the end conclusions of NEPA and ANILCA may differ, although the general impacts assessed would likely be the same (Naiman 2011).

There are three examples that illustrate the differences in analysis between the FEIS and ANILCA Section 810 Findings:

Subsistence Impacts Related to Salmon in Crooked Creek. The Section 810 Analysis, found in Appendix N, stated that "salmon may be nearly or completely extirpated from Crooked Creek by hydrological changes from mine development, operation, and closure," but that "remaining salmon resources in the Kuskokwim River drainage would be relied upon to address any lost subsistence opportunities caused by reductions in Crooked Creek's productivity. Therefore, these impacts would not result in a significant restriction to subsistence uses." This does not align with the conclusions of Section 3.13 below, which states that the potential effects to Crooked Creek would be in the middle reaches, and unmeasurable or unnoticeable in the lower river tributaries of Getmuna and Bell creeks, where the majority of salmon production occurs in this drainage.

> During Construction and Operations, the intensity of adverse impacts from reductions in habitat and flow in the middle reaches of Crooked Crook would range from unmeasurable or unnoticeable to acute or obvious. This would primarily affect rearing Chinook and coho salmon and spawning coho salmon. The most substantial proportion of adult salmon escapement and production occurs in lower Crooked Creek, Getmuna Creek, and Bell Creek. Flows in Getmuna and Bell creeks would be unaffected by Mine Site activities. In lower Crooked Creek, the intensity of adverse impacts from flow reduction during Year 20 of Operations would be unmeasurable or unnoticeable during winter low flow periods for average and low-flow years. Potential impacts from anticipated flow reductions in Crooked Creek would likely not be perceptible relative to broader populations of fish in the Kuskokwim River.

Barge Activity Impacts on Subsistence Users. The Section 810 Analysis, found in Appendix N, concluded that increased barge activity "may cause extensive interference with access to the river for subsistence users," and that "barging impacts may cause large reductions in the abundance and availability of fish resources important to subsistence users." The analysis presented in Section 3.13 and in this section of the EIS, used estimated wave forces as the basis for assessing potential impacts to fish resources and to access by subsistence users that differed

from those in the Section 810 analysis. The EIS effects were estimated to be greater in narrow segments of the river, but and reduced in other portions of the river.

Impacts to Subsistence Users From Fairwell Strip Increased Access. The Section 810 Analysis, found in Appendix N, concluded that "Alternative 2 may result in a significant restriction to subsistence use for the communities of McGrath, Takotna and Nikolai due to a substantial increase in competition for subsistence resources along the natural gas pipeline at the Farewell Airstrip." The analysis of this section considered in more detail the extent of overlap between all of the subsistence use areas by the three communities and the pipeline corridor to the south. Different data sources, including mapped subsistence use areas, testimony, and harvest ticket information, were examined to reach the differing conclusions in this section of the EIS.

3.21.6.1.2 SUBSISTENCE RESOURCE CONTAMINANT CONCERNS

The discussion of concerns about contamination of subsistence resources will focus on two discrete topics:

- waterfowl, since waterfowl could have exposure to contaminated water bodies within routine project operations, and
- consumption of subsistence resources that could be exposed to mercury, arsenic, and antimony from stack and fugitive emissions in the vicinity of the mine site.

Section 3.22.4.2.3 Human Health and Appendix AB provides a more detailed analysis of the potential for contamination of subsistence fish small mammals, waterfowl and berries by mercury and other chemicals of concern.

Mine Site Water Containment Facilities

During the scoping meetings, concern was voiced regarding the potential for migratory waterfowl to absorb contaminants from the Donlin Gold Project water containment facilities, including the contact water dam (CWD) ponds, the Tailings Storage Facility (TSF), and the pit lake. Commenters mentioned incidences of waterfowl attraction to pit lakes at other mine sites. During the Exxon Valdez Oil Spill, an analysis of impacts to subsistence found that the uncertainty and fear about contamination led subsistence hunters and fishers to doubt the safety of subsistence foods, when the health advisories differed and concluded that most subsistence resources were safe, except those from contaminated areas and those with sign of oil (Fall et al. 2001). Concerns were also raised regarding historic incidents of waterfowl impacts from contaminated pit lakes from older mining projects in other parts of the country.

The potential impact of contamination of waterfowl from Mine Site water containment facilities is discussed and analyzed in Section 3.12, Wildlife. A summary of the Ecological Risk Assessment (ERA) is presented in this section. The ERA was prepared to analyze potential risk of wildlife exposure to toxic compounds and metals in the pit lake, but did not specifically focus on waterfowl. The ERA consists of three documents, available in Appendix S. These include:

- Ecological Risk Assessment for the Proposed Future ACMA Pit Lake (ARCADIS 2013b), which reports the results of the pit lake ERA, based on a combination of water quality predictions, general literature, and studies of pit lakes elsewhere to predict exposure and effects of pit lake constituents to wildlife receptors. The ERA analyzes the pit lake infilling period (year 2 to year 52) and the mature pit lake stage (year 53 and beyond).

- Addendum to the ERA for the Proposed Donlin Pit Lake (ERM 2015), which evaluates aluminum and copper in the mature stage pit lake at year 99.
- Ecological Risk Assessment (ERA) Addendum to ARCADIS 2013 ERA (AECOM 2015f).

Analysis of reproduction, growth, and development of wildlife species that may use the pit lake and surrounding area was included in the ERA analysis. Chronic effects on representative species were evaluated because they represent long-term risks; acute effects were not evaluated since they represent short-term risks (ARCADIS 2013b, ERM 2015). The interpretation of the results of the ERA are as follows (from Section 3.12.2.5.1 in Section 3.12, Wildlife):

> For the pit lake filling scenario (year 2 to year 52), results showed that Hazard Quotients (HQs) were much less than 1 for all receptor-chemicals of potential concern (COPC) combinations. The interpretation of the HQ results for the pit lake filling scenario is that wildlife risk from chemical exposure in the ACMA pit lake water is unlikely (ARCADIS 2013b).
>
> For the mature pit lake scenario, results showed that selenium HQ no adverse effect levels (NOAELs) were less than or equal to 1 for all receptors. For antimony, HQ NOAELS were greater than one, but less than 10, for American dipper, mallard duck, mink, and tundra vole. For arsenic, HQ NOAELS were greater than one, but less than 10, for American dipper, tundra vole, wolf, and black bear (ARCADIS 2013b). A sensitivity analysis was conducted to interpret results, which showed that reductions in sediment concentrations and area uses, which are expected, would result in reductions in HQs below 1 for wildlife receptors. The interpretation of the HQ results for the mature pit lake scenario is that wildlife risk from chemical exposure in the ACMA pit lake water is unlikely.
>
> In the ERA Addendum, HQ low adverse effect levels (LOAELs) were less than 1 for both mallards and voles for both copper and aluminum, indicating no prediction of adverse risk to mallards or voles. HQ NOAELs were slightly greater than 1 for both mallards and voles for aluminum, indicating that some uncertainty exists in the effect predictions for exposure to aluminum. The interpretation of the HQ results is that potential risk of harm to wildlife from exposure to aluminum and copper concentrations is unlikely.

Concern was expressed that the new areas of standing water associated with Mine Site facilities may attract waterfowl, or that waterfowl may be attracted to areas of open water during migration. The ERA analysis, as well as the analysis of contaminant potential impacts on wildlife in Section 3.12, Wildlife, included a number of conservative (upper-bound) assumptions inherent in the risk assessment, including (ARCADIS 2013b, AECOM 2015f):

- Use of whole rock concentration data from boreholes to estimate future sediment concentrations;
- Overestimates of receptor exposure durations (full year exposure is assumed, although some species migrate during winter months, and the pit lake is expected to be frozen for up to seven months per year);
- Poor wildlife and bird habitat is the only habitat available adjacent to the pit lake and other water containment facilities, offering limited or no food sources, and unfavorable conditions for bathing or wading;

- Adjacency of other suitable, more productive natural water bodies in the vicinity of the pit lake;
- The likelihood of large-scale flocks of species being attracted to these waters is low, as populations do not typically fly over the Mine Site (incidences of attraction are associated with unpredictable, unusual, or anomalous weather or migration patterns);
- Conservative assumptions regarding dietary fractions of pit lake items; and
- Assumption of 100% bioavailability of ingested sediments and food.

Donlin Gold will follow BMPs for avian protection, and follow a wildlife protection plan, during Construction and Operations. Further mitigation measures are being considered for wildlife protection to prevent wildlife access to Mine Site water containment facilities (see Chapter 5, Impact Avoidance, Minimization, and Mitigation). Monitoring and adaptive management actions are being considered to address pit lake water quality (see Section 5.7). Project design builds in many levels of regulating water quality to address potential issues that have been anticipated and addressed.

Potential Effects of Stack Emissions and Fugitive Dust

Comments on the Draft EIS expressed concerns about the potential risk to human health associated with potential exposures to Project-related hazardous chemicals. Most of the concerns were associated with consumption of chemicals in food (fish, wildlife, vegetation) and inhalation of chemicals in air. The effects on soils of metals in dust deposition, including a complete analysis of metals (including antimony, arsenic, and mercury) in both the existing soil and the mine-produced dust is presented in Section 3.2, Soils.

In Section 3.12, Wildlife, the potential risk to animals from metals in fugitive dust released during the Construction and Operations phases, were analyzed in two ways:

- The impact of the dust produced at the Mine Site (consisting mostly of waste rock with a small amount of ore) getting into soils and plants; and
- The impact of metals released from the existing soil due to the project ground-disturbing activities.

Wildlife exposure to metals in fugitive dust could be through direct inhalation of dust or incidental ingestion of soil or food items, including vegetation that may be impacted by dust (discussed in Section 3.10, Vegetation and Nonnative Invasive Species, and Section 3.11, Wetlands). During the Closure Phase, wildlife may be impacted by the presence of deposited mine site fugitive dust emissions in the soil.

Section 3.12.2.5.3 analyzes wildlife exposure to metals in fugitive dust. The analysis concluded that the project impacts would not be expected to increase the assessed risk level for mercury and arsenic, as defined by BLM's ecological Risk Management Criteria (Ford 2004). Mercury concentrations in baseline or Year 35 soils do not exceed the criteria for any of the five wildlife species that were analyzed, and therefore the risk level is low under baseline conditions and would remain low at Year 35. Additional information on mercury impacts is provided in Section 3.22, Human Health. Arsenic concentrations in baseline and Year 35 soils exceed the

criteria by 1-10 times for three species and are less than the criteria for two species. When the BLM criteria is exceeded by 1-10 times, the risk level is defined as moderate.

A separate analysis evaluated the risk to human health from project-related exposure to hazardous chemicals from fugitive and point source emissions. This focused risk analysis (FRA) was conducted to address comments received on the Draft EIS and related discussion with cooperating agencies during a technical review workshop. The FRA can be found in Appendix AB. A quantitative human health risk assessment (HHRA), conducted by Environmental Resources Management, Inc. (ERM 2017b), is summarized in the FRA. Section 3.22.4.2.3 on Human Health describes the general methodology used for the FRA and the HHRA. The FRA is comprised of a 3-step process as follows:

- Step 1 (Exposure Pathway Analysis): Identification of primary project sources of contamination, COPCs, and determination of complete exposure pathways.
- Step 2 (Screening-Level Assessment, Single Media): Comparison of predicted media concentrations to applicable Alaska Department of Environmental Conservation (ADEC) and USEPA media-specific screening criteria for potentially complete exposure pathways (including insignificant and potentially significant).
- Step 3 (Quantitative HHRA, Multimedia): Quantitative risk evaluation of complete (insignificant and potentially significant) pathways and associated chemicals relative to baseline conditions. The quantitative HHRA estimated risks and hazards for mercury, arsenic, and antimony individually and for multiple chemicals, media, and exposure pathways. The evaluation addressed cancer and non-cancer hazards.

The Quantitative HHRA evaluated the potential exposure of child and adult subsistence users in the vicinity of the Mine Site to baseline and mine-generated levels of mercury, arsenic, and antimony as the result of consumption of representative subsistence resources. The evaluation assessed the cancer and non-cancer risks of potential exposure to these chemicals through the consumption of subsistence resources. The following steps were taken in preparing the analyses:

- The HHRA considered exposures to subsistence users who live and harvest resources within a 20-mile radius from the center of the Mine Site, which represents the spatial extent of the mercury air deposition model (Environ 2015). This is referred to as the HHRA study area. The communities of Crooked Creek and Georgetown are located within this 20-mile radius.
- The subsistence harvest patterns and quantities for Central Kuskokwim subregion communities, as described by CL Brown et al. (2012), were reviewed.
- The tissue screening-level evaluation (Appendix AB, Section AB5.4) concluded that arsenic and mercury have the potential to bioaccumulate in berries, small mammals, fish, and waterfowl that may be consumed by residents and subsistence populations. As representative subsistence resources with greatest potential for exposure to and accumulation of potential chemical contaminants, the HHRA evaluated potential effects of consuming northern pike, beaver, mallard duck, and berries. In addition, the HHRA included a comparison of northern pike estimated exposure concentrations to the Alaska fish consumption advisory levels and a qualitative evaluation for migratory fish (e.g., salmon). The HHRA evaluated risks due to northern pike fish consumption because, as

a large, relatively long-lived resident fish, they are expected to be a more conservative fish for risk estimation due to the relatively greater exposure period compared to migratory fish such as salmonids. As top predators, pike would also be expected to bioaccumulate mercury to a greater degree than lower-trophic-level fish species. The HHRA did not quantify the risks due to ingesting salmon because as anadromous species, salmon spend most of their lives and acquire most of their body mass in the ocean, outside of the HHRA study area. Salmon occur in the HHRA study area only as juveniles, when they are eating at a lower trophic level, and as spawning adults that are not eating and therefore not accumulating contaminants from prey. Thus, salmon are poor barometers of Project-related contamination of wild foods.

- The annual per capita harvest statistics from eight Central Kuskokwim communities (taken from CL Brown et al. 2012) were averaged and converted to an average daily consumption estimate in kilograms/day. It should be noted that these average daily consumption numbers are consistently higher than the specific numbers reported for Crooked Creek.
- The average daily consumption rates were compared against EPA and State of Alaska Environmental Public Health Program advisory guidelines to determine whether they were below or above guidelines

The HHRA analysis used a number of conservative (upper-bound) assumptions in order to avoid underestimating the potential effects on human health due to exposures, including that the subsistence users harvested all of these resources within a 20-mile radius of the mine site and consumed all of the resource harvested.

The HHRA and FRA concluded that project-related chemical exposures from consumption of subsistence resources are unlikely to result in unacceptable risks to subsistence users living and harvesting resources in the vicinity of the Mine Site.

3.21.6.1.3 POTENTIAL SOCIOCULTURAL IMPACTS

In addition to the impacts addressed under ANILCA Section 810, a number of potential sociocultural impacts to subsistence need to be examined. Alaska studies of subsistence, international studies of mine impacts on indigenous people (especially in Canada), and comments during the Donlin Gold EIS Scoping meetings suggest a number of potential sociocultural impacts to consider. Further insights into potential sociocultural impacts were gained through two Subsistence and Traditional Ecological Knowledge workshops with local residents in Aniak in November 2013 and in Anchorage in March 2014, held as part of the process of preparing this EIS. Representatives of many EIS Analysis Area villages attended these meetings. Another source of information on sociocultural impacts to subsistence was a series of EIS-related interviews with 32 respondents that were conducted in seven Central Kuskokwim communities[3] and Bethel during July and August 2014 (AECOM 2015a).[4]

[3] The seven Central Kuskokwim River villages are: Stony River, Sleetmute, Crooked Creek, Chuathbaluk, Aniak, Upper Kalskag, and Lower Kalskag.

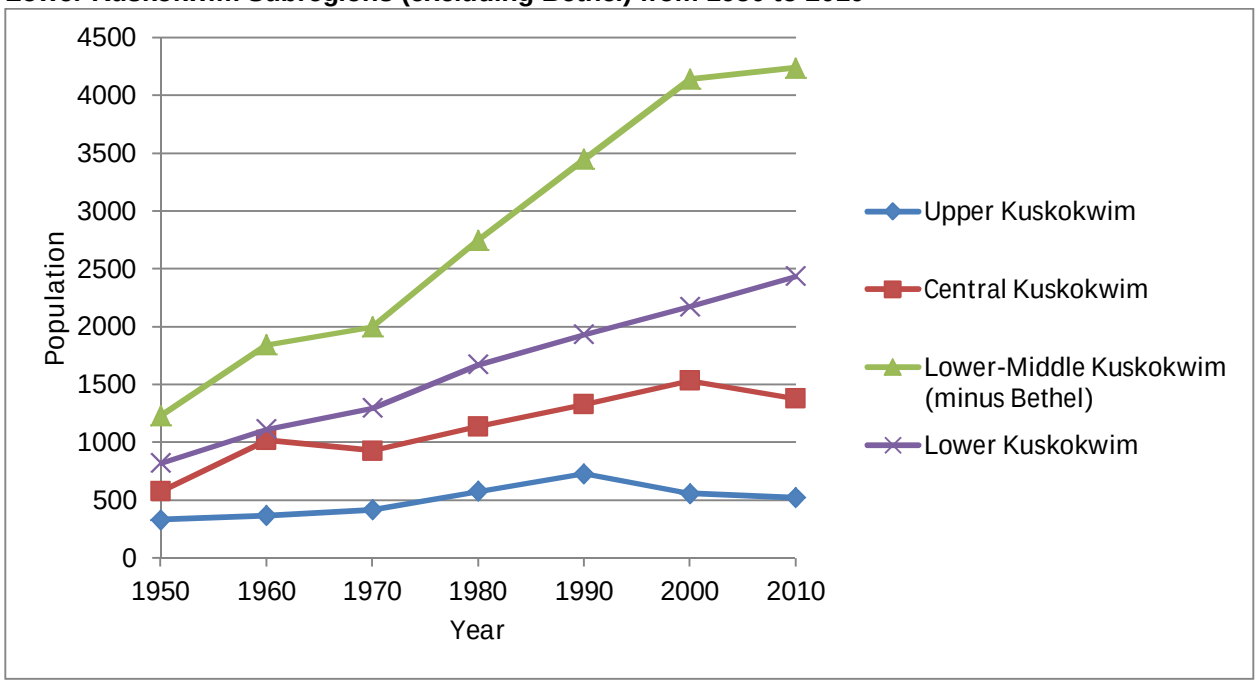
Changes in Population

The subsistence-reliant communities of the EIS Analysis Area include those that are growing and shrinking in population size due to births, deaths, and migration, which are influenced by many variables. Changes in employment and income may lead to changes in the size of community populations, which may affect subsistence harvests. Small communities with declining populations may be vulnerable to continuing decline, in which case the important subsistence traditions of that community would suffer and perhaps be lost. Large communities with growing populations may also have growing needs for subsistence resources, and this may contribute to greater competition with other communities and subregions.

Small communities in the Kuskokwim River basin appear to be demographically vulnerable, with big effects from a few families moving away. In contrast, the larger communities of the region appear more demographically robust, with continuing rates of population growth. The Upper, Central, Lower-Middle, and Lower Kuskokwim subregion populations have increased since the 1950 census. Between 2000 and 2010, the Central Kuskokwim and Upper Kuskokwim subregions decreased in population (Figure 3.21-58).Bethel, the largest community on the Kuskokwim River, has increased in population from 651 people in 1950 to 6,080 in 2010 (Figure 3.21-59). Declines in some smaller communities are related to outmigration due to high costs (especially high energy costs) and declining levels of paid employment and income. Currently several communities have populations near or less than 100 people (Chuathbaluk, Crooked Creek, Lime Village, Nikolai, Red Devil, Sleetmute, Stony River, Takotna, Oscarville, and Platinum), and four communities do not have year-round resident populations (Georgetown, Napaimute, Telida, and Medfra). These four communities do have tribal members and some return to the area to pursue traditional hunting and fishing activities, which represents a relatively new subsistence pattern based on seasonal relocations between larger communities (including Anchorage and Bethel) to rural villages. Those who permanently relocate to urban areas (such as Anchorage) and return only in the summer, would no longer qualify as a federal subsistence user under ANILCA.

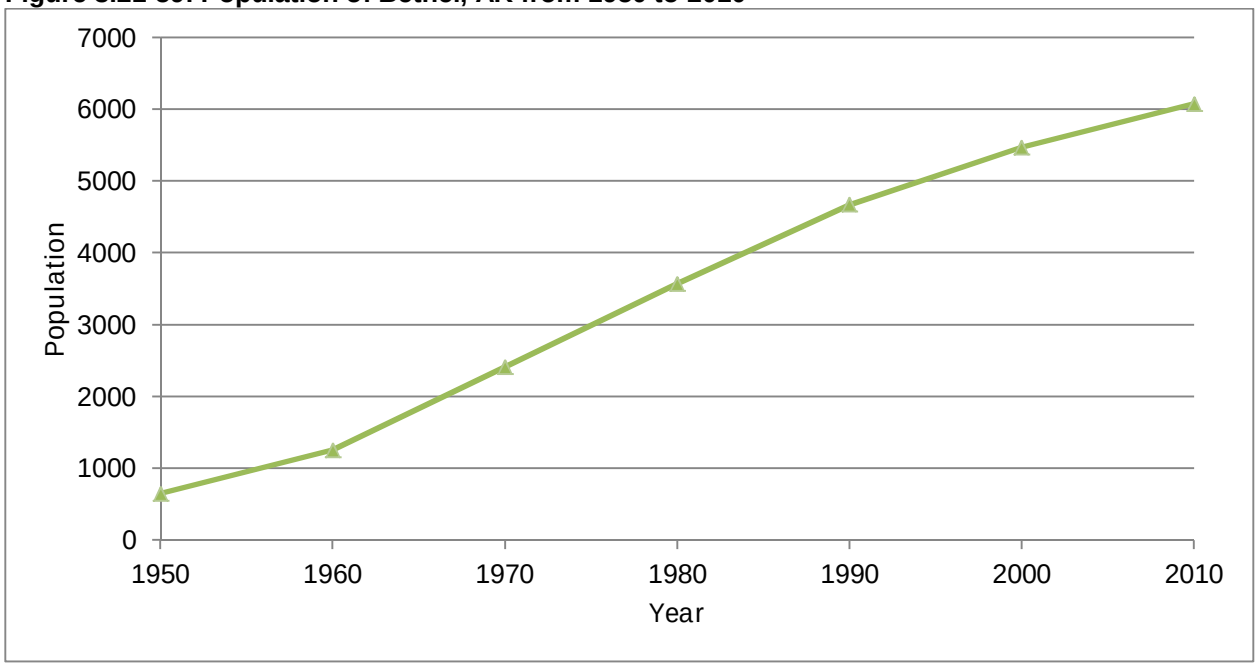
[4] The results of the 2014 interviewing on the Kuskokwim River (AECOM 2015a) show striking parallels to results from a study conducted by the North Slave Metis Alliance (2001), considering the potential impacts of changes in employment, income, and work shift schedules from the proposed Diavik Diamond Mine Project in the Northwest Territories, Canada. For a summary of comparative results, see AECOM 2015a.

Figure 3.21-58: Population of Upper, Central Kuskokwim, Upper Kuskokwim, Lower-Middle and Lower Kuskokwim Subregions (excluding Bethel) from 1950 to 2010



Source: USCB 2013b.

Figure 3.21-59: Population of Bethel, AK from 1950 to 2010



Source: USCB 2013b.

Estimated population changes in the next 30 years differ between subregions on the Kuskokwim River, according to projections based on census data prepared by ADOL (Bishop et al. 2007). This study examined birth rates and migration rates to generate estimates. It did not take into account any new large-scale economic projects in the regions, such as the Donlin Gold Project. The Department of Labor predicts that the Bethel Census Area (including the Central Kuskokwim communities) will see population growth of just less than 1 percent per year, from a 2012 population of 17,600 to a 2042 population of 23,696. In contrast, the Yukon-Koyukuk Census Area (which includes some of the Upper Kuskokwim villages) is predicted to decline by just less than 1 percent per year, from a 2012 population of 5,682 to a 2042 population of 4,411.

From these large census area projections, it appears likely that the Upper Kuskokwim River villages would continue the decline seen from 1990–2010 into the next 30 years and that the communities of the Central Kuskokwim River would continue the decline seen in 2000-2010 into the next 30 years. In contrast, the larger communities of the lower Kuskokwim River (below Lower Kalskag) are likely to continue to grow.

Employment at the Donlin Gold Project may reverse the trend of out-migration in the Upper and Central Kuskokwim Subregions and some families that might have otherwise moved away, may stay due to new employment opportunities. This would contribute to stable or increased community populations, and stable or increased subsistence harvests. On the other hand, employment at the Mine Site may increase out migration resulting in even greater population decline, and in the extreme case the possible disappearance of unique subsistence patterns and cultural traditions based in particular communities.

Employment opportunities may augment the trend of population growth in the larger communities of the lower Kuskokwim River. A large portion of the employment and income from the Mine Site may go to residents of Bethel, the regional center in the Kuskokwim drainage, and to residents of other communities in the Lower Kuskokwim subregion. This could lead to increases in population above current projections by the Alaska Department of Labor that could lead to increased subsistence harvests by residents of this subregion and the possibility of increased competition between communities in the Kuskokwim drainage for highly valued resources such as Chinook salmon and moose. The extent to which subsistence harvests increase may be moderated by other factors.

Changes in Population and Rural Status

Commenters on the Draft EIS noted that residents of Bethel were concerned that population growth association with the Donlin Gold Project would jeopardize the subsistence status of Bethel. Under the Federal Subsistence Management Program, the federal subsistence priority applies to residents of rural places. During the early development of the Donlin Gold Project EIS, policy discussions were underway concerning federal rural determinations, fueling this concern. However, under new secretarial rulemaking adopted in January 2017, the rural status of Bethel has been reaffirmed.

As directed in late 2009 by the Secretary of the Interior with concurrence of the Secretary of Agriculture, the Federal Subsistence Board initiated review of the rural determinations process in late 2012. Over the next several years, this included several rounds of meetings with the Federal Subsistence Regional Advisory Councils, as well as formal consultation with federally recognized Tribes and ANCSA corporations and public review of a draft rule.

The former regulations required a decennial review following the U.S. Census, and employed population thresholds along with other factors. Communities of greater than 7,000 were presumed to be non-rural unless other dimensions demonstrated a predominantly rural character, such as reliance on local resources. Since the 2010 Census population of Bethel was 6,080, potential for population growth contributed to uncertainty and concern.

In January 2017, the Federal Subsistence Board adopted new regulations on Nonrural Determinations. Secretarial rulemaking eliminated the mandatory decennial review and the population thresholds. These features were eliminated in the Federal Subsistence Board regulations as well, and instead, the Board's regulations focused on the identification of Nonrural communities, using a comprehensive approach addressing many factors, in which population size and industrial facilities may play a role. Board consideration of a Nonrural status would only occur on a case-by-case basis, resulting from a proposal to make such a change submitted by members of the public or agencies.

With elimination of mandatory review and elimination of the population thresholds, the rural status of Bethel under the Federal Subsistence Management Program is more secure.

Changes in the Cultural Composition of a Community

Increased employment opportunities offered by the mine may also have an effect on community populations through the in-migration of new residents, and changes in the cultural composition, or percentage of Alaska Natives and non-Natives in a community. Such changes could potentially affect subsistence food harvest levels within a community. Statistically, communities with larger non-Native populations have lower subsistence harvest levels (Wolfe et al. 2011).

Local residents also recognize that in-migration by non-locals could affect the cultural context of subsistence activities.

> People that come and choose to adapt to the way of life that is being conducted within the villages are most welcome if they choose to do that. But those who see it and treat it as just a recreational opportunity, and just the way they treat the animals, like the way they throw fish around, they don't have the appreciation. It's great fun and it's something we should all be able to do [hunting and fishing].
>
> But anyway, that's really what's at the heart of it is how people use and respect the animals and do they come and adapt to the community and not look to have the community change to accommodate their ways. And that applies as much in the personal sense as in the larger sense of mines and economic development and the whole economic structure, I guess, if you will, and the -- the way of life that's centered around money versus living with the -- within a natural world you were born with and being a part of that world. That's all we are trying to do there. It's a difficult one (Greg Roczicka, URS 2013c).

The effects of historical in-migration and employment opportunities on the cultural composition of key regional communities is reflected in current populations of communities such as McGrath (54 percent Alaska Native), Aniak (73 percent Alaska Native), and Bethel (68 percent Alaska Native), while many of the smaller communities have Alaska Native populations exceeding 90 percent.

The likely effects of in-migration by non-Alaska Natives associated with employment at the Donlin Gold Project are examined below. The enclave policy of the mine would likely limit the numbers of in migrants who take up residency in communities within the region.

Changes in Employment and Incomes

In the early 1980s, Alaska researchers began documenting the inter-relationship of the cash economy and subsistence success including harvest, processing and sharing (production). Many studies revealed a strong correlation between success in the wage sector and success in the subsistence sector; a healthy wage sector can support a healthy subsistence sector in rural areas of the state (Kruse 1979; Wolfe et al. 2010). Other statistical analyses found that communities with higher proportions of non-Alaska Native residents and higher average incomes had lower rates of subsistence food production, particularly when the community is road connected (Wolfe and Walker 1987; Wolfe et al. 2011). Magdanz et al. (2016) revisited these analyses, with particular focus on remote rural communities (i.e., those that lack road or Alaska ferry system connection, and changes over time). This restudy concluded that urban Alaska, road-connected Alaska, and remote rural Alaska displayed differences in the associations of size, ethnicity, income and subsistence production. In remote rural Alaska, Magdanz et al. (2016), found a pattern of "significant decline in subsistence production, but no significant change in real incomes. In all regions, subsistence harvests remain sufficient to provide, on average, an adult's protein needs."

The effect of income on subsistence success (subsistence production) is particularly pronounced among households with distinctive demographic structures. Research has found that in many communities 30 percent of households produce 70 percent of the subsistence harvest. These "super households" are distinctive because they include multiple working-age males, have high incomes, and are often involved in commercial fishing. These three factors enable high producing households to combine subsistence activities with paid employment and to deploy considerable labor in flexible ways to maximize harvests, which they then share with other households in the community. By contrast, low producing households usually have low incomes, are led by a single female or non-Native head of household, are single-person households, or households composed of elders (Wolfe et al. 2010).

The relationship between higher incomes and increased subsistence production was corroborated during the two workshop meetings and the interviews conducted by the EIS team (URS 2013c, 2014e; AECOM 2015a). For both the workshops and interviews, local tribal governments were asked to select participants who were particularly knowledgeable about subsistence traditions and uses. Additional information on participants and methods is found in the cited materials. Local residents reported that participation in subsistence activities varied among households and that for many households the recent and rapid increases in the cost of gas, combined with the limited and declining availability of jobs in the smaller villages, have made it harder for residents to pursue the full seasonal round of subsistence activities. They also thought that these declines could be offset by employment opportunities at the mine that would enable people to invest in subsistence equipment and operating costs. Furthermore, they thought these investments could partially offset limitations of work schedules for shift workers, allowing the employees to conduct their subsistence harvest activities more efficiently.

Changes in income created by employment in the Donlin Gold Project may have indirect effects on subsistence food harvests, depending on how families and individuals choose to spend their

incomes. If families such as the super households described above continue to invest in new equipment, and households that are more marginal also invest in subsistence activities, then subsistence harvest could be expected to increase. Technology that is more efficient would compensate for the time away for employment shifts at the mine by enabling subsistence users to obtain subsistence foods in a shorter time (Kruse 1979). More reliable or increased subsistence success or production by high-producing households may maintain or increase the sharing of subsistence products along traditional networks, especially to elders, single-mother households, and the infirm. Sharing supports community well-being and reinforces traditional values.

While some households may choose to invest in subsistence, others may not. Households may choose to use the larger incomes to purchase more commercial food, adjusting to on-going changes in food tastes. In this case, subsistence harvests could decline or remain flat. Purchases of commercial foods may increase if subsistence fish stocks (like Chinook salmon) and game populations (moose) remain low and if harvests of salmon and moose continue to be low, despite more efficient equipment to pursue them. A corollary to the increased purchase of store food includes health problems such diabetes.

Commenters to this EIS noted that larger incomes may lead some individuals to decrease their subsistence activities. As noted above, statistical analyses found that communities with higher average incomes had lower rates of subsistence food production (Wolfe and Walker 1987; Wolfe et al. 2011; Magdanz et al. 2016).

Another consequence of more efficient equipment is that hunters are able to quickly travel long distances and increase their hunting areas. If hunters are able to increase their hunting areas, this could increase the potential for competition for such scarce resources as salmon and moose between residents of subregions and local communities. In turn, this may result in more time spent working with regulatory agencies to resolve between-community competition.

Further, employment opportunities can bring increased income which can be used for a variety of beneficial and detrimental activities.

Remote Industrial Enclave and Commuting

Several Canadian and international studies concluded that large-scale mining operations often share some common employment and income characteristics that can affect subsistence harvests (Gibson and Klinck 2005). When a mine is remotely located, away from existing communities, workers commute from their homes for their work shift. This has several important implications. Since the mining company provides transportation to the mine, workers may travel from local communities, regional hubs, or more distant cities without cost to the employee. Some local residents working at the mine may choose to leave the region and establish households elsewhere. According to testimony in Scoping meetings for the Donlin Gold EIS, this has already occurred, and local communities are concerned about this potential effect. If a large proportion of young men and male heads of mature households (i.e., those most likely to contribute to high harvesting households) were to relocate to urban centers, this could affect the configuration of labor within family groups, overall community subsistence production, and sharing of subsistence foods.

Remote Mine Site enclaves have other characteristics that influence sociocultural impacts. Enclave-based employment minimizes the direct demographic changes in nearby communities. The Donlin Gold Mine Site is a self-contained industrial worksite, not a new community.

Families do not accompany workers, and the mine workforce does not generally create new demands on local or regional housing, education, and health care infrastructure. Since non-local workers can commute to the worksite, there is less of a tendency for non-local workers to move to the region of the mine. In Alaska, the industrial enclave policies typically prohibit workers from hunting and fishing from the work site, minimizing concerns about competition for local fish and game resources. While Mine Site policies can minimize competition by employees, there are other potential sources of competition indirectly associated with the Donlin Gold Project, as discussed below.

Rotational Work Schedules and Year-round Employment

Rotational work schedules could affect subsistence production and the social dynamics of households and communities. Subsistence is labor intensive with the harvest and processing of food traditionally organized with distinctive roles for men and women, elders, middle aged-adults, and young people. Shift patterns of employment at the mine would result in the periodic absence of men and women who are involved in subsistence. Year-round work shifts instead of seasonal employment may affect the ability of hunters to spend long periods on the land resulting in the loss of skills and traditional knowledge.

Employed family members may have less time available to hunt and fish, and less flexibility in scheduling to hunt and fish, particularly if regulatory restrictions limit the windows for hunting or fishing. The absence of key family members may also affect the training and practice in harvesting for younger family members. Families commonly make adjustments in labor in subsistence production, but it would be a challenge, and in some cases could lead to stress and tension which could result in social problems or increased out-migration. Adjustments to compensate for the absence of family members include:

- Specialization of subsistence production, with non-employed members doing more fishing and hunting, training younger kin-group members, and sharing with employed family members.
- Further changing in gender roles, with women doing more hunting or fishing, and/or men doing more processing.
- Specialization of wage employment by some members of the community.

Taken together, the studies described in this section on sociocultural impacts suggest five categories of sociocultural impact for analysis:

- Availability of employment can affect the population size and cultural composition of local communities and indirectly affect the harvest of subsistence resources;
- Increased incomes can positively or negatively affect subsistence activities; people can choose to purchase new equipment to more effectively hunt, gather, and fish, or use their money to purchase store food;
- Occupationally defined work enclaves with transportation that allows workers to live anywhere may encourage the formation of new households within the local communities, or encourage regional out-migration that may cause communities to lose their most productive hunters/fishers and affect the configuration of labor within family groups;

- Rotational work schedules can provide flexibility for subsistence pursuits or interfere with established seasonal subsistence patterns and culturally defined work roles, within family groups; and
- Year-round work shifts instead of seasonal employment may affect the ability of hunters to spend long periods on the land resulting in the loss of skills and traditional knowledge, or they may also provide hunters with predictable schedules to effectively plan their subsistence activities and use that time to share their skills and traditional knowledge with their families.

3.21.6.1.4 ASSESSMENT CRITERIA FOR RATING EFFECTS ON SUBSISTENCE

Table 3.21-25 provides the impact methodology framework applied to assessing direct or indirect impacts on subsistence activities based on the four NEPA Impact Assessment factors of magnitude / intensity, duration, geographic extent or scope, and context (as described in Section 3.0, Approach and Methodology). As noted in the opening section of 3.21.6, the analysis is focused on estimating likely levels of effects.

Table 3.21-25: Impact Criteria for Effects on Subsistence

Type of Effect	Impact Factor	Assessment Criteria		
Changes in Resource Abundance and Availability	Magnitude or Intensity	Changes would necessitate small adjustments in harvest pattern. Alternative resources are readily available at low cost and effort increases of less than 10%, resulting in reduction in overall harvest success of less than 10%.	Changes require adjustments affecting high productivity subsistence resources or more than one seasonal pattern. Alternative resources available at cost and effort increases of up to 25%, resulting in reduction in overall harvest success of 25% or less.	Changes necessitate large-scale changes affecting high productivity resources or harvest practices through multiple seasons of the year. Alternative resources unavailable or available only at cost and effort increases greater than 25%, resulting in reduction in overall harvest success greater than 25%.
	Duration	Changes in use patterns would last for the duration of the Construction Phase and would be expected to return to pre-activity levels after actions causing impacts were to cease.	Changes in use patterns would last for the life of the project.	Changes in use patterns would extend beyond the life of the project and after Closure.
	Geographic Extent or Scope	Effects realized by communities within a subregion, such as the Upper Kuskokwim,	Effects realized by communities across subregions or throughout the EIS	Effects realized throughout the EIS Analysis Area and may extend beyond the EIS

Table 3.21-25: Impact Criteria for Effects on Subsistence

Type of Effect	Impact Factor	Assessment Criteria		
		Central Kuskokwim, etc.	Analysis Area.	Analysis Area.
	Context	Affects harvest of locally abundant subsistence resources.	Affects harvest of high volume or highly valued subsistence resources which may be subject to urgent conservation measures or for which alternatives are not readily available.	Affects subsistence resources that are of high cultural importance which cannot be efficiently replaced.
Changes in Access	Magnitude or Intensity	Changes would disturb or displace subsistence users' access limited to portions less than 10% (if measurable) of the subsistence use area for generally abundant resources. Access to alternative areas is readily available at cost and effort increases of less than 10%.	Changes would disturb or displace subsistence users' access to portions up to 25% of the subsistence use area for generally abundant resources. Access to alternative areas is available at cost and effort increases of up to 25%.	Changes would displace effective access of subsistence users to portions greater than 25% of subsistence use area for generally abundant resources. Access to alternative areas is available at cost and effort increases greater than 25%.
	Duration	Same as for Subsistence Resources		
	Geographic Extent	Same as for Subsistence Resources		
	Context	Affects access to localized areas supporting harvest of abundant resources.	Affects access to areas supporting harvest of high volume or highly valued subsistence resources.	Affects access to areas supporting harvest of subsistence resources that are very difficult to replace in productivity or cultural importance.
Changes in Competition	Magnitude or Intensity	Changes in competition for generally abundant resources resulting in reduction in overall harvest success of less than 10%.	Changes in competition for resources in limited abundance, resulting in noticeable reduction in harvest success of 25% or less.	Severe changes in competition for resources in limited abundance, resulting in reductions in harvest success greater than 25%.
	Duration	Same as for Subsistence Resources		
	Geographic	Same as for Subsistence Resources		

Table 3.21-25: Impact Criteria for Effects on Subsistence

Type of Effect	Impact Factor	Assessment Criteria		
	Extent			
	Context	Competition affecting use of abundant resources.	Competition affecting use of resources without readily available alternatives.	Competition affecting uses with no available alternatives.
Sociocultural Effects due to Income, Out-migration, Work Schedule Conflicts	Magnitude or Intensity	Sociocultural changes affect less than 10% of households, and/or result in less than 10% reductions in participation of households in seasonal round of subsistence activities.	Sociocultural changes affect up to 25% of households, and/or result in reductions of less than 25% in participation of households in seasonal round of subsistence activities.	Sociocultural changes affect greater than 25% of households, and/or result in greater than 25% reductions in participation of households in seasonal round of subsistence activities.
	Duration	Same as for Subsistence Resources		
	Geographic Extent	Same as for Subsistence Resources		
	Context	Rural subsistence practices on federally managed lands and waters are recognized and protected in law (Title VIII of ANILCA). In addition, these culturally distinct, subsistence-based social groups are very rare in the US.		

3.21.6.2 ALTERNATIVE 1 – NO ACTION

3.21.6.2.1 EFFECTS ON SUBSISTENCE RESOURCES, ACCESS, AND COMPETITION

Under the No Action Alternative, the Donlin Gold Project would not receive permits, and Donlin Gold would not establish a Mine Site, develop a Transportation Corridor, or construct a Pipeline in the EIS Analysis Area. Exploration and support activities were discontinued when the permit applications were submitted in 2012/2013. According to comments on the Draft EIS, placer mine operations active in the vicinity in recent years may return to operation. Calista and TKC would determine future uses of the site, including access for subsistence purposes. Subsistence resources that had been displaced during the exploration and baseline studies period would likely reoccupy the Mine Site area, and subsistence users from Crooked Creek may reestablish their use of the area. There would be no increase in competition from non-local residents for subsistence resources where access to resources might have been changed.

Alternative 1 would have no effect on climate change in the EIS Analysis Area, as related to subsistence. Existing trends in climate change, described in Section 3.26, Climate Change, would continue.

3.21.6.2.2 EFFECTS ON SOCIOCULTURAL ASPECTS OF SUBSISTENCE

If the Donlin Gold Project is not authorized, then the local employment associated with Project exploration and environmental studies of recent years would not continue. Most of the exploration and environmental studies associated with employment ended with submission of the permit applications in 2012, and this action would continue the resulting decrease in the current number of jobs available in the region. It would have an indirect effect on Calista shareholders since the advance royalties that Donlin Gold pays to Calista Corporation would be terminated (see Section 3.18.2.1.1, Socioeconomics). The ongoing lower level of employment would likely not be easily offset and could result in some families leaving the region, continuing a recent trend (Section 3.18.2.1.1, Socioeconomics).

While communities would continue to have subsistence-based economies, the ongoing loss of this source of employment could lead to less available income to purchase fuel or ammunition, and this may cause those households to alter their subsistence activities. Many residents have stated that subsistence activities are currently constrained by the high cost of fuel in particular. However, to the extent that seasonal work at the Donlin Gold exploration camp had reduced labor and time available for subsistence, then loss of this seasonal work would increase labor and time available for subsistence activities. In some cases, the reduced income levels loss of income may have contributed to increased reliance on subsistence foods because there would be less money available to purchase non-subsistence food. Families may have adapted their harvest practices to concentrate on resources that can be harvested with relatively little cost. For some families, the ongoing reduction in income may result in relocation to areas with more work available, and the related reduction of subsistence production for their home community.

3.21.6.2.3 SUMMARY OF IMPACTS – ALTERNATIVE 1

Under the No Action Alternative the Donlin Gold Project would not occur. Without disturbance at the site, habitat would recover and wildlife would reoccupy the area, providing the basis for subsistence harvests to be reestablished in the Mine Site area. These would be positive effects on subsistence resources and access. There would be no direct effect to competition for subsistence resources. Potential effects to the sociocultural aspects of subsistence could include loss of additional income from the absence of further exploration. In addition, these people would return to their previous level (pre-mine exploration employment) of availability for labor and time for subsistence activities. The duration of these effects would extend indefinitely. The extent or scope of effects would be realized by rural communities across the EIS Analysis Area. The context in which the impacts would occur would affect areas of high cultural importance to the affected communities. While communities would continue to have subsistence-based economies, there could be less available income to purchase fuel or ammunition, and this may cause those households to alter their subsistence activities. Subsistence resources and subsistence activities would not be affected beyond those that were affected by the exploration activities, and would otherwise continue as they have in the past.

3.21.6.3 ALTERNATIVE 2 – DONLIN GOLD'S PROPOSED ACTION

Based on comments on the Draft EIS from agencies and the public, one route option has been included in Alternative 2 to address concerns due to pipeline crossings of the Iditarod National Historic Trail (INHT):

- North Option: The MP 84.8 to 112 North Option would realign this segment of the natural gas pipeline crossing to the north of the INHT before the Happy River crossing and remain on the north side of the Happy River Valley before rejoining the alignment near MP-112 where it enters the Three Mile Valley. The North Alignment would be 26.5 miles long, with one crossing of the INHT and only 0.1 mile physically located in the INHT right-of-way (ROW). The average separation distance from the INHT would be 1 mile.

3.21.6.3.1 MINE SITE

This section describes likely or estimated impacts to subsistence fish and wildlife resources potentially affected by the Mine Site facilities and activities in routine operations. This section relies on conclusions found in Section 3.12, Wildlife and Section 3.13, Fish and Aquatic Resources. The potential effects of fuel spills are addressed separately in Section 3.24, Spill Risk.

To analyze likely impacts to access to subsistence uses, community use areas documented in 2009 and 2010 from Aniak, Chuathbaluk, Napaimute and Crooked Creek, Georgetown, Red Devil, Sleetmute, and Stony River were reviewed to identify overlaps with the Mine Site (CL Brown et al. 2012; Brown et al. 2013). Only Crooked Creek residents had a variety of subsistence resource uses in the Crooked Creek drainage in the vicinity of the Mine Site, as described more fully below. Aniak residents documented a large area for berry picking starting at the Donlin Gold exploration camp and extending north. As this is discontinuous with large areas used by Aniak residents closer to home, and was not identified in the Aniak subsistence use maps prepared in 1986 (Brelsford et al. 1987, depicted in CL Brown et al. 2012) this may have been associated with residents working at the exploration camp.

Napaimute resident uses areas were described as occurring predominantly in the lower Kuskokwim River in the vicinity of Bethel, where most tribal members now reside (Brown et al. 2013). Fall moose hunting, however, occurred in a narrow corridor along the mainstem of the Kuskokwim River from Bethel to McGrath, along with areas near Paimute Slough on the Yukon River and near Shageluk. Salmon and non-salmon fish harvests occurred in the vicinity of Napaimute village. None of the documented Napaimute use areas extended up the Crooked Creek drainage to the vicinity of the Mine Site.

Effects on Subsistence Resources (Construction and Operations)

Under Alternative 2, the Construction and Operations of the Mine Site could result in four possible mechanisms of ongoing direct impacts to subsistence resources and harvest practices:

- habitat loss at the Mine Site;
- displacement of animals from heavy equipment activity and noise in the vicinity of the mine;
- fugitive dust deposits on plants used for subsistence; and
- concerns from subsistence users about contamination of waterfowl in the TSF, pit lake and other water retention structures.

Subsequent paragraphs estimate the likely magnitude, extent or scope, duration, and context for these types of effects.

Localized habitat loss and displacement of black bears and fur-bearing animals[5] in the vicinity of the Mine Site has been observed by local residents during the 16 years of exploration and baseline studies, and it is likely that initial construction and subsequent build-out of the major facilities at the mine site would further displace some local animal populations. Waterfowl harvest areas in the Crooked Creek drainage below the Mine Site may also be affected.

Fugitive dust from Construction and Operations has the potential to be deposited on berries near the mine site, which would make subsistence users wary about harvesting this resource. However, most berrypicking by residents of Crooked Creek takes place in a large area away from the Mine Site. Section 3.10.3.2, Vegetation, notes that: "The intensity of the impacts of fugitive dust on vegetation is expected to vary depending on proximity of vegetation to the source of the dust. Dust may cause variable physiological changes to vegetation pending exposure length or level." Aniak residents' subsistence use areas maps show a discontinuous zone of berrypicking starting from the Mine Site to the north. A portion of this zone would likely become less preferred, due to disturbance and dust from the Mine Site activities, however most Aniak berry picking activity takes place closer to the community.

Potential impacts to subsistence use of waterfowl could result from concerns about contamination of waterfowl as they utilize standing water components at the mine site, such as the pit lake, CWD ponds, or the TSF. As noted in the Wildlife section, Section 3.12, mine area water containment facilities would be characterized by on-going mining activity during Operations, and would be unlikely to support growth of vegetation or invertebrates that might serve as food sources for waterfowl. Without food sources, waterfowl are unlikely to stay long in any open water areas. Additionally, open water areas would be expected to freeze during winter months for up to seven months. In all, migratory waterfowl are expected to be at low risk from ingestion of toxic water, food or sediment at the water storage features. Communication with subsistence users about the ecological risks and waterfowl exposure to contamination is important to convey accurate information and to address concerns and perceptions about contamination.

Potential impacts to subsistence fish resources, including both salmon and non-salmon species, could result from habitat removal (in-stream, and wetland and riparian buffers) and fish losses, as well as changes in streamflow, stream temperature, and stream sedimentation. Construction and operations of the Mine Site would directly remove or modify habitat and reduce stream flow from American Creek (4.1 stream miles lost), Anaconda Creek (1.5 stream miles lost), Lewis Gulch (2.3 stream miles lost), and Snow Gulch (0.05 stream miles lost) in the middle to upper reaches of the Crooked Creek drainage. Taken together this would represent the loss of 8 miles of perennial stream habitat, of which 0.66 miles is classified as anadromous, and the remainder is non-anadromous. Omega Gulch would be affected by mine water management practices. (For additional details, see Table 3.13-23 and associated discussion in Section 3.13, Fish and Aquatic Resources.) Section 3.13, Fish and Aquatic Resources, concluded that:

> During Construction and Operations, the intensity of adverse impacts from reductions in habitat and flow in the middle reaches of Crooked Crook would range from unmeasurable or unnoticeable

[5] Fur-bearing mammals, taken by trapping, are also referred to as small land mammals in the ADF&G's Division of Subsistence studies. These include beaver, fox, and American or pine marten. For ease of reading, this group of subsistence resources will be referred to as fur-bearing animals in this section.

to acute or obvious. This would primarily affect rearing Chinook and coho salmon and spawning coho salmon. The most substantial proportion of adult salmon escapement and production occurs in lower Crooked Creek, Getmuna Creek, and Bell Creek. Flows in Getmuna and Bell creeks would be unaffected by Mine Site activities. In lower Crooked Creek, the intensity of adverse impacts from flow reduction during Year 20 of Operations would be unmeasurable or unnoticeable during winter low flow periods for average and low-flow years. Potential impacts from anticipated flow reductions in Crooked Creek would likely not be perceptible relative to broader populations of fish in the Kuskokwim River.

Impacts of habitat loss and displacement of black bears, fur-bearing animals, waterfowl, and any potential impact to berry resources due to fugitive dust at the mine site, would primarily affect residents of Crooked Creek and Aniak since these are the only communities with contemporary subsistence use area that extends to the vicinity of the Mine Site (see Figure 3.21-16 and Figure 3.21-60). Lower Kuskokwim River villages do not use the Crooked Creek drainage for large mammals harvests (Figure 3.21-61). Disturbance effects would extend beyond the Mine Site, overlapping with some Crooked Creek subsistence uses in the Crooked Creek drainage. (For discussion of overlap between the Crooked Creek use area and the Angyaruaq [Jungjuk] Port site, see Section 3.21.6.3.2.)

The estimated direct impacts to subsistence resources associated with routine operations of the Mine Site would affect uses by residents of Crooked Creek and Aniak, as discussed above. No other Central Kuskokwim River communities have subsistence use areas overlapping with the Mine Site. For analysis of impacts under spill scenarios, which would affect subsistence uses by more communities along the Kuskokwim River, see Section 3.24.6.21.

Subsistence Resource Contaminant Concerns

A summary of the findings of the FRA (Appendix AB) and the HHRA for all action alternatives involving mining is provided below:

- Non-cancer risk estimates (HQs and HIs) were all at or less than 1 for both baseline and future risks for potential receptors, indicating that non-cancer effects are unlikely.
- Baseline risk estimates for mercury are consistent with a mercury hair study completed by the ADHSS. ADHSS conducted methylmercury testing of hair samples from pregnant women in selected communities, including the Upper Kuskokwim River region communities. Every study participant had a hair mercury level that was below the ATSDR No Observed Adverse Effect Level (15.3 ppm), as well as the Environmental Public Health Program cut-off for follow-up (5 ppm) (ADHSS 2013), also indicating exposure to mercury in the region is not at unacceptable levels.
- For arsenic, the cancer risk estimates, both baseline and future risk estimates are $5x10^{-5}$, which is within the EPA's risk management range of $1x10^{-4}$ to $1x10^{-6}$. Future estimates of cancer risks were similar to baseline, indicating no unacceptable change in risk.
- The HHRA evaluated risks due to northern pike fish consumption because, as a large, relatively long-lived resident fish, they are expected to be a more conservative fish for risk estimation due to the relatively greater exposure period compared to migratory fish such as salmonids. As top predators, northern pike would also be expected to bioaccumulate mercury to a greater degree than lower-trophic-level fish species. The results indicate HQs and incremental cancer risks below those considered substantial (i.e., HQ less than 1 and incremental cancer risk less than 1×10^{-6}).

- Estimates of future northern pike mercury concentrations are lower than state of Alaska (2016) fish consumption advisories for northern pike harvested from the Kuskokwim River in the vicinity of the Project. Therefore, subsistence populations currently consume northern pike at rates well below the northern pike consumption advisory level for the state of Alaska, and consumption would be expected to remain below the advisory level in the future.

The results of the analysis concluded that in the area of analysis, exposure to mercury at baseline and estimated project levels would be below the advisory levels of both the Environmental Protection Agency (EPA) and State of Alaska Environmental Public Health Program. For arsenic, exposure at baseline and estimated project levels are within EPA's acceptable risk management range. The small increases in constituent concentrations estimated to occur outside of the Mine Site due to Project-related activities are unlikely to result in unacceptable risks to human populations who would have the highest exposure (i.e., subsistence populations).

Based on these findings, other human populations, such as residents in the region who do not participate in subsistence uses, would not be expected to be exposed to any substantive risk due to exposure to Project-related concentrations of mercury, arsenic, or antimony. All risk levels would generally be consistent with baseline conditions.

For more detail, see Section 3.22.4 and Appendix AB.

It should be noted that fugitive dust control systems will be included at all points in the process where mercury might be emitted which are expected to remove 99.6 percent of all mercury processed and outperform national standards established by the EPA in 2011 (Hatch 2014).

Effects on Subsistence Resources (Closure)

After closure of the Mine Site under Alternative 2, active mining would cease and the site would be reclaimed, greatly reducing the effects on subsistence resources and their habitats. The Mine Site would slowly revegetate and return to a more natural state regaining value as habitat for several subsistence species such as moose and black bear and fur-bearing animals (Section 3.12, Wildlife). At Closure, the TSF would be drained of water, and both the TSF and Waste Rock Facility (WRF) would be recontoured with reserved topsoil, and revegetated.

The pit lake would fill over approximately 50 years. The closure plan calls for perpetual operation of a water treatment plant to treat pit water to meet water quality standards for discharge into Crooked Creek below Omega Gulch between the confluence of American Creek and Anaconda Creek. Compliance monitoring is required to assure that water quality standards are maintained to minimize impacts to fish and aquatic resources. According to the analysis in Section 3.13 Fish and Aquatic Resources, water temperature changes associated with pit lake treated water discharges during summer would result in "an adverse effect [on fish] that may not be noticeable, because of the extremely limited number of additional TUs [Temperature Units] (1.4 percent of total needed to reach emergence) that might be accumulated during the anticipated discharge period." The pit lake would become a new area of standing water that could attract wildlife and migratory birds. Wildlife species and birds are not expected to be at risk from ingestion of surface water from the pit lake (Section 3.12, Wildlife). As noted above for the Operations Phase, some subsistence users may be concerned about the contamination of waterfowl by these waterbodies at the Mine Site after Closure.

Closure and reclamation of the Mine Site would reduce impacts relative to the preceding periods of Construction and Operations. Without the disturbance of the mine operation, and with revegetation of the main features of the mine, wildlife such as black bears and furbearers are likely to reoccupy the Mine Site over time. After 50 years, when the pit lake fills, the discharge of treated pit water would increase streamflow in Crooked Creek, with small seasonal water temperature increases in the lower reaches where most salmon spawning occurs. The pit lake would introduce a new standing water structure, but the risk to wildlife and birds from chemical exposure in the pit is unlikely or low (see Section 3.12.2.5).

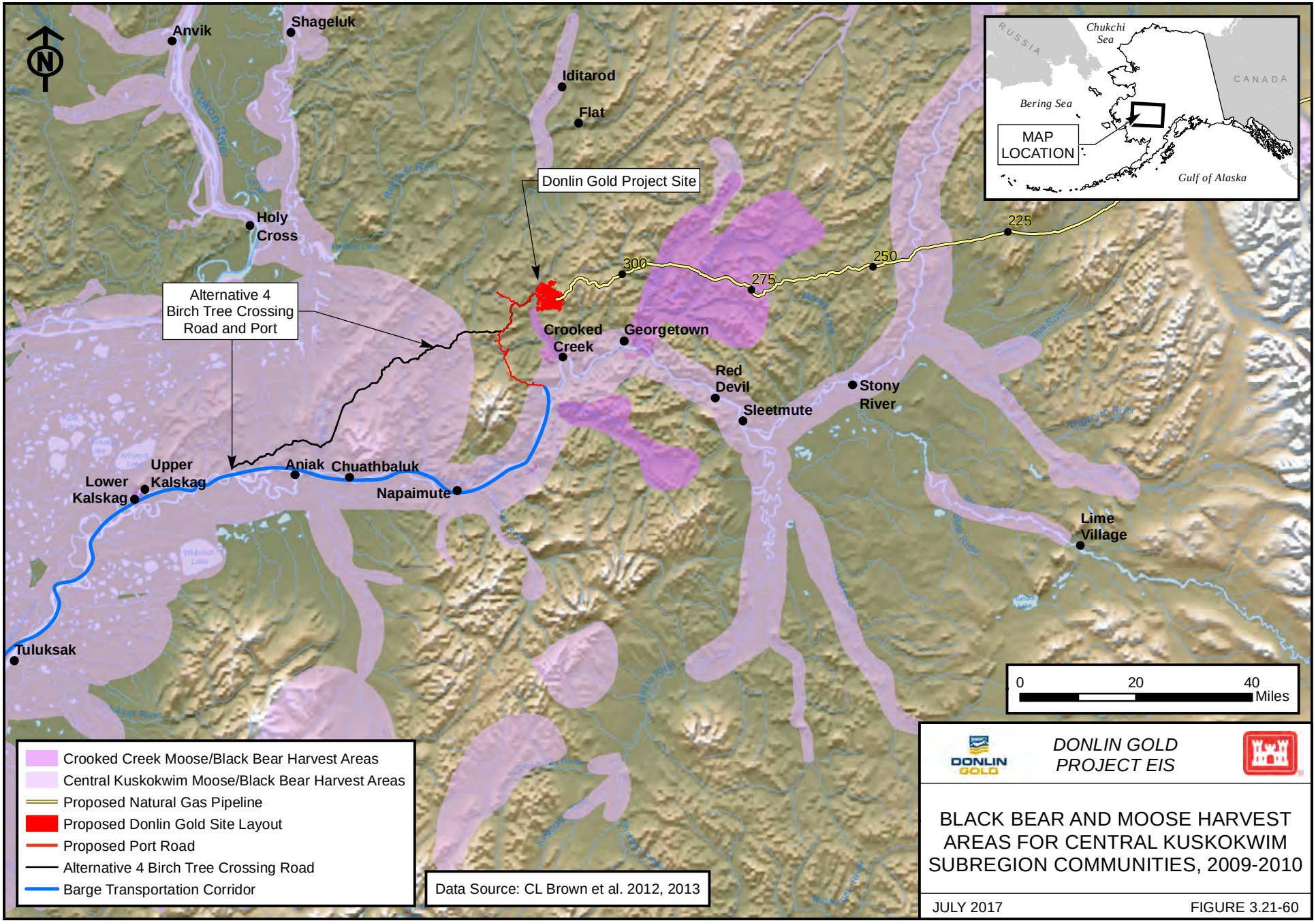
Effects on Access to Subsistence Resources (Construction and Operations)

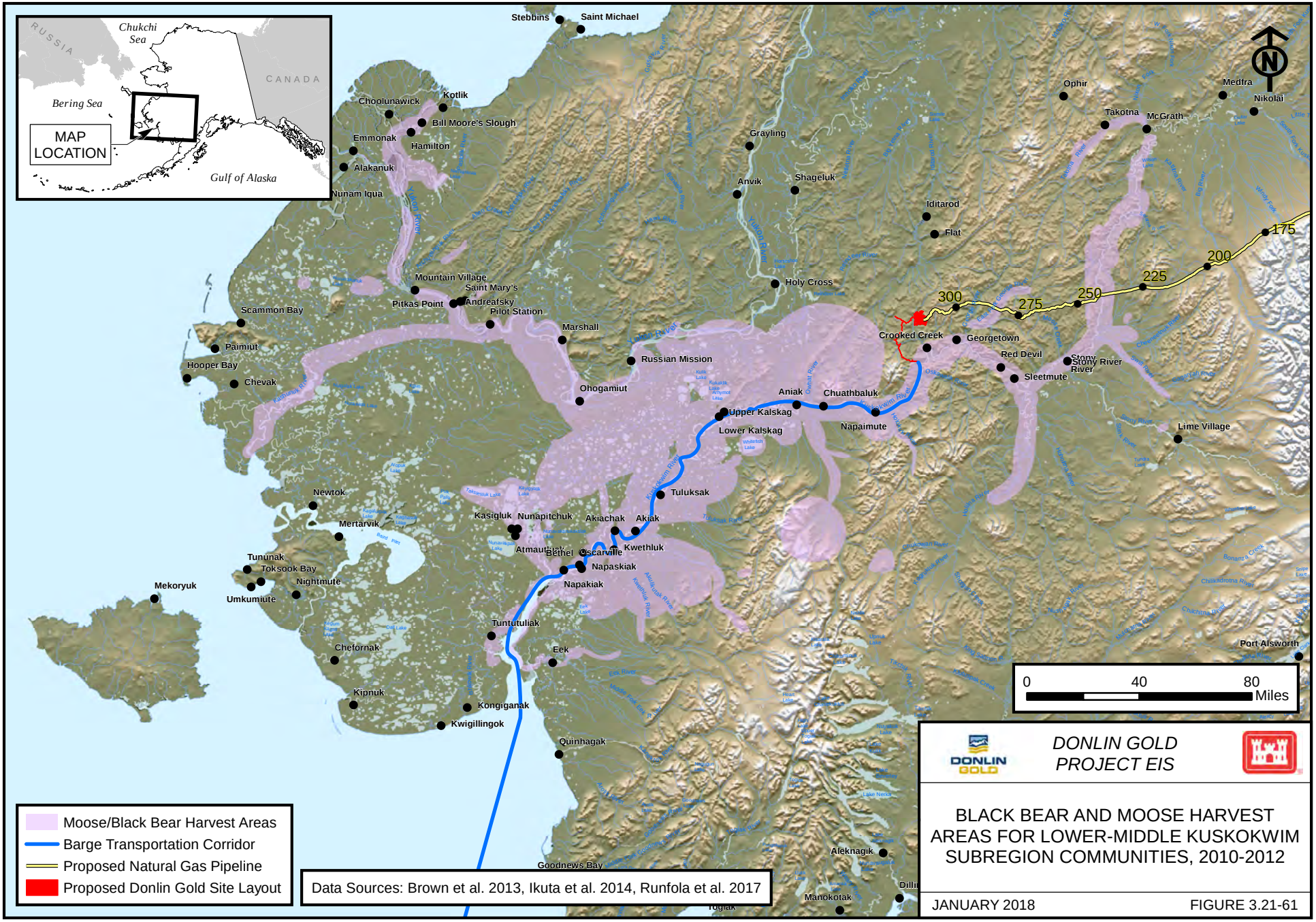
Impacts on access to subsistence resources can include legal barriers such as trespass prohibitions, physical barriers such as fencing off lands to block access by other users, or activities that deter use of the area. Displacement of subsistence use areas due to disturbance can also be considered an impact to access to subsistence resources, in that subsistence users would have to compensate by going to other areas to maintain their subsistence uses and meet subsistence needs.

Under Alternative 2, Construction and Operations of the Mine Site would restrict access to subsistence resources and use areas in the limited area of active mining. Subsistence access to the mine site vicinity historically included foot and snowmachine travel. Subsistence use area maps for the period 1964 through 1986 showed that Aniak and Crooked Creek residents trapped along the Crooked Creek riparian corridor, including tributaries downstream and to the west of the Mine Site (Brelsford et al. 1987, adapted in Figure 4.14-1 in ARCADIS 2013a). During scoping meetings, local residents reported they reduced their use of this area during the summer exploration and baseline study programs over the past 16 years. Access and subsistence hunting at the Mine Site would be prohibited during Construction and Operations for safety reasons. In addition, Crooked Creek subsistence hunters may avoid a zone around the active mine site, due to the disturbance of noise and activity.

Limitations on access and displacement of subsistence activities would primarily affect the community of Crooked Creek, since the Mine Site itself falls adjacent to a portion of the village's contemporary subsistence use area (see Figure 3.21-16 and Figure 3.21-17 above). Except for the Aniak berry-picking area north of the Mine Site, the subsistence use areas of other villages within the EIS Analysis Area do not overlap with the Mine Site. See Figure 3.21-60 and Figure 3.21-61 above for large mammal harvest areas of the Central Kuskokwim River and Lower-Middle Kuskokwim River villages respectively.

The contemporary subsistence use area for all species for Crooked Creek residents, as documented in 2009 (CL Brown et al. 2012), extends along the Kuskokwim River in a narrow corridor from the vicinity of Lower Kalskag to approximately Sleetmute. Harvest activities extend in larger areas up the key tributaries of the Oskawalik River, the George River, and the Holitna River (see Figure 3.21-62 and Figure 3.21-63 for bird and vegetation harvest areas for the Central Kuskokwim River villages).


Anvik
Shageluk
Iditarod
Flat
Donlin Gold Project Site
Holy Cross
Alternative 4 Birch Tree Crossing Road and Port
225
250
275
300
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Lime Village
Tuluksak
MAP LOCATION
Chukchi Sea
Bering Sea
RUSSIA
CANADA
Gulf of Alaska
0
20
40
Miles
Crooked Creek Moose/Black Bear Harvest Areas
Central Kuskokwim Moose/Black Bear Harvest Areas
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Barge Transportation Corridor
Data Source: CL Brown et al. 2012, 2013
DONLIN GOLD
DONLIN GOLD PROJECT EIS
BLACK BEAR AND MOOSE HARVEST AREAS FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009-2010
JULY 2017
FIGURE 3.21-60


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
Stebbins
Saint Michael
Choolunawick
Kotlik
Bill Moore's Slough
Hamilton
Emmonak
Alakanuk
Nunam Iqua
Grayling
Anvik
Shageluk
Iditarod
Flat
Holy Cross
Ophir
Medfra
Nikolai
Takotna
McGrath
Mountain Village
Saint Mary's
Pitkas Point
Andreafsky
Pilot Station
Scammon Bay
Marshall
Paimiut
Hooper Bay
Chevak
Russian Mission
Ohogamiut
Crooked Creek
Georgetown
Red Devil
Stony
Stony River
Sleetmute
Aniak
Chuathbaluk
Upper Kalskag
Lower Kalskag
Napaimute
Lime Village
Tuluksak
Newtok
Mertarvik
Kasigluk
Nunapitchuk
Akiachak
Akiak
Atmautluak
Bethel
Oscarville
Kwethluk
Napaskiak
Napakiak
Tununak
Toksook Bay
Nightmute
Umkumiute
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Goodnews Bay
Aleknagik
Manokotak
Port Alsworth
175
200
225
250
275
300
0
40
80
Miles
Moose/Black Bear Harvest Areas
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Data Sources: Brown et al. 2013, Ikuta et al. 2014, Runfola et al. 2017
DONLIN GOLD
DONLIN GOLD PROJECT EIS
BLACK BEAR AND MOOSE HARVEST AREAS FOR LOWER-MIDDLE KUSKOKWIM SUBREGION COMMUNITIES, 2010-2012
JANUARY 2018
FIGURE 3.21-61

An extensive area around Crooked Creek village is also used for subsistence, with smaller corridors up Crooked Creek itself to the approximate vicinity of the Mine Site, as well as Getmuna Creek and Bell Creek. The estimated total area of the Crooked Creek subsistence use area in 2009 was 1,245.9 square miles (CL Brown et al. 2012). In addition, Crooked Creek residents traveled up the drainage beyond the mine site continuing on to the Yukon River drainage and Flat, primarily for trapping (David John, cited in URS 2014d).

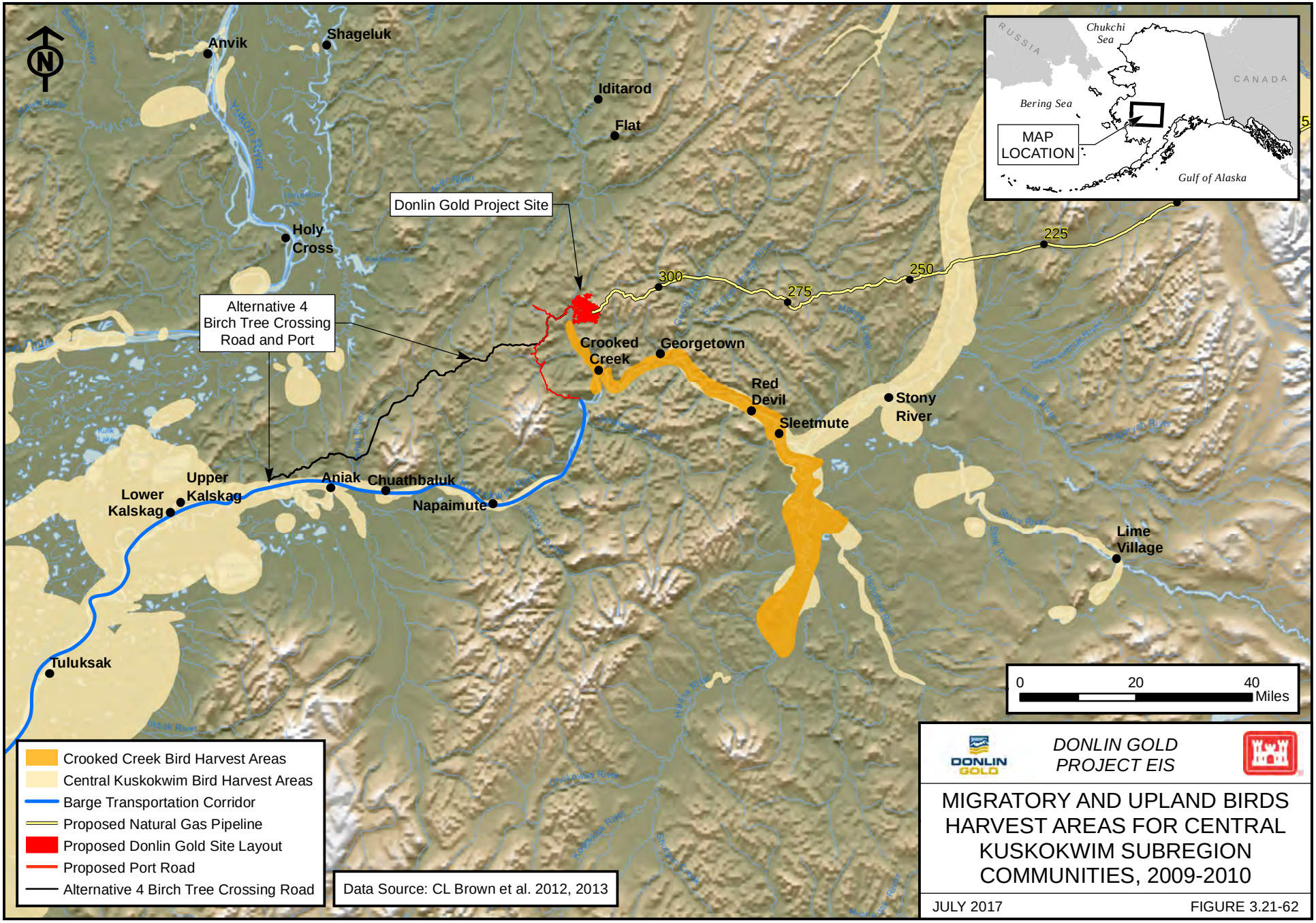
Within the overall subsistence use area for Crooked Creek residents, there are areas of focused concentrated effort for particular hunting and fishing activities. The black bear hunting and harvest areas mapped in 2009 extend up the Crooked Creek drainage to a point above the Mine Site, while moose hunting is concentrated away from the Crooked Creek drainage, on the mainstem of the Kuskokwim River, and in the Oskawalik and George River drainages. The 2009 map of use areas for fur-bearing animals includes a 3- to 5-mile reach of Crooked Creek in the vicinity of the Mine Site, and another small zone in the upper reach of Bell Creek. Ducks and geese are harvested up Crooked Creek to a point above the Mine Site. Berries and greens are taken in a zone around the community extending up the Crooked Creek drainage to approximately the mouth of the Getmuna Creek (Figure 3.21-16 above). For impacts to Crooked Creek subsistence fishing, see the discussion under Transportation Corridor below. The more specific map of the 2009 subsistence use area for fishing indicates that the lower reach of the Crooked Creek drainage is used for salmon fishing to a point below the Mine Site at Bell Creek (Figure 3.21-65).

In all, during Construction and Operations the built out footprint of facilities at the Mine Site would cover about 9,000 acres or 14 sq. miles. The mining activities would also cause displacement of subsistence activities in the vicinity of the Mine Site, overlapping with the reported 2009 subsistence use area in the Crooked Creek drainage. Contemporary subsistence uses in the vicinity of the Mine Site, include bear hunting, trapping, hunting for duck and geese, and harvesting berries.

Other portions of the contemporary subsistence use area support the majority of subsistence hunting and food production. For example, subsistence fishing which accounted for 81 percent of subsistence food in 2009 occurred outside of the mine site vicinity. Compared to several decades ago, residents report that the seasonal mine exploration activities have already resulted in redirecting subsistence activities efforts away from the campsite. As indicated by Crooked Creek residents, traditional subsistence resources such as black bear have already been affected by exploration and baseline study activity at the Donlin Gold camp. While Crooked Creek residents have already redirected their subsistence use area, Construction and Operations of the Mine Site would intensify this pattern and extend the duration for just over 30 years. The disturbance from a seasonal camp during the exploration period would become year-round, and the 30-plus year period would extend across a generation, limiting the opportunities for elders who formerly hunted and trapped in this particular portion of the Crooked Creek subsistence use area to mentor younger people in this location.

Effects on Access to Subsistence Resources (Closure)

During Closure, access to the Mine Site would be allowed once the reclamation process is complete. As a result, access to available subsistence resources may become possible at the Mine Site (a water treatment plant would begin operating at the pit lake to treat water discharged to Crooked Creek when the pit lake is near capacity [SRK 2017b]).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Georgetown
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Sleetmute
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Lime Village
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Tuluksak
MAP LOCATION
Chukchi Sea
Bering Sea
Gulf of Alaska
RUSSIA
CANADA
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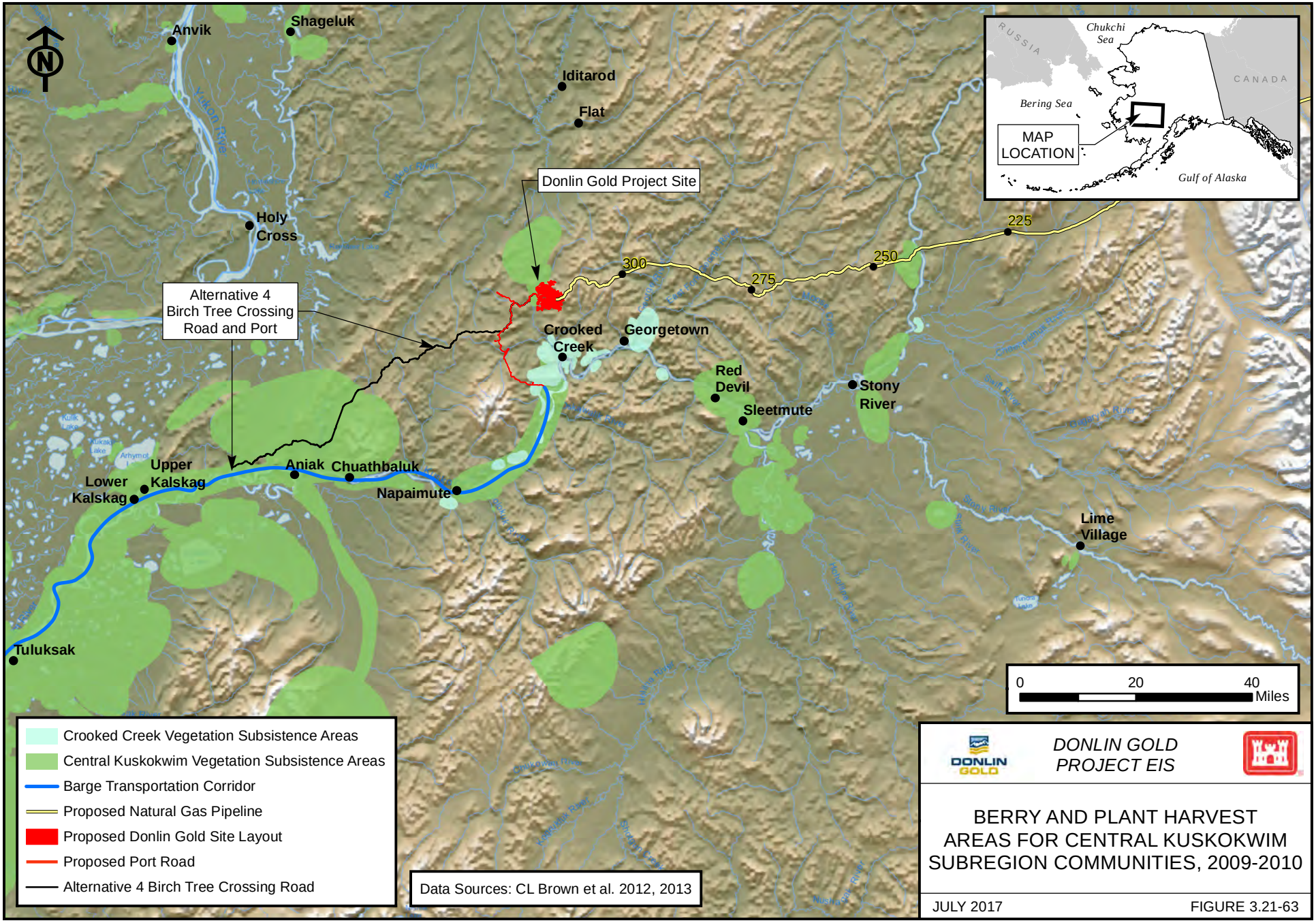
Miles
Crooked Creek Bird Harvest Areas
Central Kuskokwim Bird Harvest Areas
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Data Source: CL Brown et al. 2012, 2013
DONLIN GOLD
DONLIN GOLD PROJECT EIS
MIGRATORY AND UPLAND BIRDS HARVEST AREAS FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009-2010
JULY 2017
FIGURE 3.21-62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Donlin Gold Project Site
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Alternative 4 Birch Tree Crossing Road and Port
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Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Lime Village
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Tuluksak
Yukon River
Kuskokwim River
Russia
Chukchi Sea
Canada
Bering Sea
MAP LOCATION
Gulf of Alaska
0
20
40
Miles
Crooked Creek Vegetation Subsistence Areas
Central Kuskokwim Vegetation Subsistence Areas
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Data Sources: CL Brown et al. 2012, 2013
DONLIN GOLD
DONLIN GOLD PROJECT EIS
BERRY AND PLANT HARVEST AREAS FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009-2010
JULY 2017
FIGURE 3.21-63

Effects on Competition for Subsistence Resources (Construction and Operations)

The Donlin Gold Project would result in new employment opportunities, including some non-local employees, but this would likely result in very little additional competition for subsistence resources due to several factors. First, Donlin Gold would prohibit participation in hunting and fishing activities by employees and contractors while they are on site during all phases of the Project. Donlin Gold would also prioritize hiring shareholders from the land-owning ANCSA Corporations (Calista and The Kuskokwim Corporation). Section 3.18, Socioeconomics, estimates that 50-60 percent of the workforce of 3,200 workers during Construction and 1,000 workers during Operations would come from the Yukon Kuskokwim region. Particularly during Construction, the temporary, non-local workers are likely to commute from their homes outside of the region, and it would be unlikely that the Construction Phase would result in an influx of new residents to the local communities of the EIS Analysis Area. During the Operations Phase, most non-local employees are likely to continue to commute to the worksite. A small number of non-local employees may find the region to be attractive, and they may establish households in the EIS Analysis Area – most likely in Aniak or Bethel, where housing, stores, and other amenities are more available than in the smaller villages.

Competition among residents of the Kuskokwim River drainage for scarce subsistence resources could also be indirectly affected by the Donlin Gold Project, through additional subsistence activity that could be supported by mine employment income. These effects would not be concentrated at the Mine Site, but would extend throughout the Kuskokwim River drainage. From the late 1960s to the early 2000s, Central Kuskokwim residents objected to growing competition from Lower Kuskokwim River residents, who used large boats to come in large numbers to hunt on the Holitna and Hoholitna rivers in Unit 19A. The Board of Game responded in the late 1980s by limiting the size of boat motors (i.e., 40 horsepower or less) that could be used in moose hunting on these tributaries. When the moose population declined precipitously, a moratorium on moose hunting in Unit 19A was adopted in the last decade. Lower Kuskokwim River communities generally redirected their moose hunting to the Lower Kuskokwim or Lower Yukon rivers. Concerns over conservation and allocation of Chinook salmon on the Kuskokwim River also saw differences from the 1980s to the present between Lower Kuskokwim River communities generally favoring larger harvest allocations, while Central Kuskokwim River communities advocated for larger escapements to provide for fishing opportunity in their subregion. By 2014, the Chinook salmon decline on the Kuskokwim River led to the most conservative subsistence fishing management approach ever for this highly valued resource.

Competition for these resources among regional residents has been the result of a complex mix of changes in income (i.e., the growth in commercial fishing and adoption of bigger boats and motors) and ecological conditions. Recovery of moose populations in Unit 19A is likely in coming decades, while the future trend for Kuskokwim River Chinook salmon is uncertain. No specific estimates on the intensity or timing of in-region competition for resources are possible, but changes in employment from the Donlin Gold Project are likely to contribute to increased competition among regional residents for key resources.

Effects on Competition for Subsistence Resources (Closure)

With cessation of Mine Site Operations, the employment and income associated with the project would be limited to a very small maintenance staff. During the Construction and Operations phases, the Donlin Gold Project would likely indirectly contribute to increased competition as noted in the preceding paragraphs. However, after Closure, the indirect effects of mine employment and income in contributing to competition among Kuskokwim River residents for moose and Chinook salmon would cease.

Effects on Sociocultural Aspects of Subsistence (Construction and Operations)

Since subsistence activities depend on income to pay for equipment and operating costs, increased income is often associated with increased subsistence production. This finding is supported by data from the 32 interviews conducted in seven Central Kuskokwim communities and Bethel. Respondents were asked whether employment at the mine would have an effect on subsistence harvests in their community. For the interviews, local tribal governments were asked to select participants who were particularly knowledgeable about subsistence traditions and uses. Additional information on participants and methods is found in (AECOM 2015a). In addition to the employment income addressed in the interviews described below, the Donlin Gold Project would also generate revenues to the landowners. Calista would receive royalties and TKC would receive lease payments. The corporations would have discretion in making disbursement to shareholders from this income. See Section 3.18.2.2.1 for details.

A majority (65 percent of respondents) thought employment would have a positive effect because it would mean that people would have the money to purchase gasoline, ammunition, and equipment. As Mr. Bob Aloysius of Upper Kalskag stated:

> "...employment makes it more possible for people to do a better job of subsistence hunting, fishing, trapping, and gathering because it gives them the opportunity to get some gasoline for outboards, snowmachines, four wheelers (Bob Aloysius in AECOM 2015a)."

Mr. Aloysius also thought employment at the mine would enhance subsistence opportunities.

> Like I said in the beginning, a cash economy makes it easier to hunt, fish, trap, gather, and share. Two weeks up there, two weeks home. If it is the summertime you can fish, if is fall you can hunt, if it is winter you can trap. I would just love it, if I was able to work for two weeks up there and come back home and do all kinds of subsistence activities. I think it is more enhancement for the young people. Right now, basically young people are totally unemployed. There is no opportunity to make any money. Once they get the opportunity to work up there for two weeks, they can come back and be a big support to their family. I know this because I have a lot of nephews here in Lower who are always eager to help but their income level is such that it is always impossible. Two weeks on, working, make money. Two weeks come back home and be able to hunt, fish, trap, and gather, to me is awesome (Bob Aloysius in AECOM 2015a).

A minority of respondents was less positive and said it would depend on the person: if people were already involved in subsistence, they would use the money for equipment. This was especially true of older people, but as they pointed out, not everyone is involved in subsistence. Ms. Mary Willis from Stony River reflected on the existing differences in participation of subsistence harvests:

> Respondent: Kind of, I think maybe 30 percent. I know it wouldn't be over 50 percent because a lot of the younger people don't do much subsistence; just mostly the older people and just very few of the younger people.
>
> Interviewer: Do you think people would use new income to buy more subsistence gear?
>
> Respondent: Once again, that's the older people that aren't able to work are the ones who would buy the subsistence stuff, but they wouldn't be employed. The younger people are more likely to buy snowmachines.
>
> Interviewer: More recreational?
>
> Respondent: More recreational than subsistence, I think (Mary Willis in AECOM 2015a).

Occupationally defined work enclaves with transportation that allow workers to live anywhere may encourage the formation of new households within the local communities, or encourage regional out-migration that may cause communities to lose their most productive subsistence producers. Young single men and male heads of mature households are categories of persons most likely to be employed at the Mine Site, and their absence from their community could undermine a key part of the collaborative tradition that forms the foundation of the subsistence economy resulting in a loss of traditional skills and knowledge.

Out migration because of employment at the Donlin Gold Project was of considerable concern to those interviewed by the EIS study team (AECOM 2015a). Respondents were asked three questions:

- Would working at the mine affect people's choice of whether to stay or leave the community?
- What would be the consequences if people did move?
- What would encourage people to stay in the community?

These questions generated a wide variety of responses. Migration out of rural Alaska is currently a serious problem for some communities, often attributed to lack of jobs and high costs of basic services. In a small community, if families leave, the school closes, population declines, and federal or state funding is reduced.

Some respondents noted that people are already leaving some communities but a good job, opportunities to pursue subsistence activities, and improved village infrastructure would enable people to stay or to return. Most respondents said they could not predict what individuals would do and that it depended on the person and the situation. A smaller number of respondents predicted that people would simply leave. A respondent from Upper Kalskag thought that employment at the mine would be an important reason to stay in a community.

> Boy, I think it would enable them to stay because there would be an opportunity for employment and to live at home. It would help with their opportunity to live in the village. Even though some of the commodities are high, they would have a better opportunity to buy the fuel oil, groceries mainly, and pay for electricity and flush toilets. Being employed up there [the mine], gives the ability for people to stay home, stay in the village. Because in Anchorage, there is no opportunity to hunt, fish, trap, gather, and share (Bob Aloysius in AECOM 2015a).

The effects of occupationally defined work enclaves and their influence on out-migration from local communities would be the result of three factors: first, the Donlin Gold Project would result in new employment since the priority in hiring would be for shareholders from the land-owning ANCSA corporations, Calista and The Kuskokwim Corporation. Locally available employment is seen by local residents as reducing the likelihood of out-migration. Keeping young, working-age families in the community would have a positive effect on subsistence production. Secondly, by increasing the local wage economy communities would have the means to improve infrastructure, which would also act to reduce out-migration. The third factor in stemming out-migration is whether regional and village corporations, tribes, and cities invest in community infrastructure, such as opening up land to build new homes, lowering energy costs, and providing amenities such as high-speed internet or recreational facilities.

In addition to the comments from the interviews, there is the experience of the Red Dog Mine which started operations in 1989 and in which up to 50 percent of NANA shareholders employed at the mine moved out of the region (Section 3.18.2.2.1, Socioeconomics). During the exploration and baseline studies period, many Calista Corporation shareholders were employed at the Donlin Gold Project site (134 of 198 employees in 2007) (ARCADIS 2013a), and relatively few moved away from the region as a result. For the Operations Phase, with a larger labor pool in the Calista Corporation region than in the NANA region, a larger share of mining payroll may go to regional residents, and "a larger percentage may choose to stay in the region" (ARCADIS 2013a).

Rotational work schedules and year-round rather than seasonal employment could also affect subsistence production and the social dynamics of households and communities. Subsistence is labor intensive with the harvest and processing of food organized by gender. Generally, men hunt and fish, and women process, although this is changing with more flexibility in recent years. Young single males and mature males are often the primary harvesters in a community and they are also the most likely to be employed at the mine. As Ms. Lisa Feyereisen of Chuathbaluk described this concern:

> So it definitely has impacts within the family situation, the dynamics of the family. And the family is our subsistence [producing unit] in my family. You know, we gather food together. We travel together. There is a book called Always Getting Ready. And that's kind of how I feel our life is out here. We are getting ready to go to work. We are getting ready to go home. We are getting ready to go to bingo. We are getting ready to go on the boat again. We are getting ready to go hunting. We are always packing things back and forth, back and forth to the boat, to the snowmachine, taking clothes on, putting clothes off, you know, depending on the weather. And when you are always getting ready by yourself and your significant other isn't there, it does add a complexion (Lisa Feyereisen URS 2013c).

However, when asked if rotational shift schedules would affect subsistence harvests, approximately 56 percent of those interviewed in 2014 thought there would be no negative net effect, often due to the benefit of increased income. Many noted that rotational work schedules provide more flexibility and were common in both the mining and oil and gas industries. Ms. Elena Phillips of Crooked Creek explained:

> No, it wouldn't because they'd be at work. They'd be earning money to pay their bills and whatever. You know, buy stuff that they need and still be able to come back in two weeks

> to subsistence and do what they need to do at home, and go back again to work. (Elena Phillips in AECOM 2015a).

Approximately 44 percent of respondents thought that rotational work schedules interfered with subsistence. Ms. Gina McKindy from Aniak related that even with flexible work schedules, the absence of a spouse had an effect on her household's subsistence production.

> I definitely agree with that, first hand. I am aware. My husband worked there for 9 years. It was before the permitting process. So, the campsite was small enough where they really tried to make accommodations and adjust to the big subsistence times where they needed to be home. [Donlin] was flexible with schedules but it definitely impacts. It definitely changes, if it is a main provider of the family, if they aren't home to do the hunting. That is a tremendous impact. My husband finally caught a moose, not last year but the two prior years. Before that it was eight years that he didn't get one. Not so much only because of the mine, but it played a part (Gina McKindy in AECOM 2015a).

The effects of rotational work schedules on subsistence harvests would vary, since many families would adapt positively and some would find this an adverse effect. Legal hunting seasons are short and if employment schedules interfere with these seasons, then the effect on subsistence harvests could be greater. A primary hunter's absence from the community at critical times of the year could have a greater impact, though the effects could be reduced with strategic periods of leave of an appropriate length of time during key subsistence harvest periods.

Taking the themes together, likely changes to sociocultural aspects of subsistence during Construction and Operations include:

- Additional jobs and incomes, and increased dividend payments to Calista and TKC shareholder (if adopted by their boards), are likely to increase subsistence activity, since more households would afford equipment and operating costs. Given estimated local and shareholder hiring during the Construction Phase, 25 to 29 percent of households could be affected,[6] while during Operations, mine employment could affect 8 to 9 percent of households. Employment is not likely to be evenly distributed across all households in communities within the EIS Analysis Area, so the percent of households affected could vary widely. Based on participation in TKC and shareholder hiring patterns during the exploration and baseline studies period, the smaller communities near the mine are likely to have higher rates of employment. In light of current economic limitations faced by many subsistence user households, the income from the Donlin Gold Project would make an important and positive difference throughout the EIS Analysis area, and more so for the small communities near the Mine Site. Out-migration by young families is a risk because of jobs and ability to commute to the worksite. Local residents have mixed views on the likelihood of outmigration occurring. However, based on experience with the Donlin Gold Project during the exploration period, and with the Red Dog Mine, it is estimated that 30 percent of local shareholder employees would relocate to urban areas. Distributed across the estimated 6,500 households in the

[6] This estimate is based upon an estimate of 1,600 to 1,900 construction jobs distributed among members of an estimated 6,500 households in the EIS Analysis Area. For the Operations Phase, an estimated 500 to 600 jobs would be distributed among members of an estimated 6,500 households in the EIS Analysis Area.

EIS Analysis Area, this would represent about 3 percent of households. Employment and migration patterns are not likely to be uniformly distributed across all households in EIS Analysis Area communities, so the percent of households affected by outmigration could vary widely, particularly for the smaller communities near the mine, which are likely to have higher rates of employment.

- For rotational and year-round work and effects, a majority of local residents had positive views and thought that rotational work schedules would not have a negative effect. Respondents noted that some people already have experience working shifts that took them away from home. They also pointed out that it was necessary to have money in order to pursue subsistence activities and that two weeks off-duty each month was enough time, especially if the time off coincided with hunting seasons in the fall and the salmon runs in the summer, and there were family members at home who could help out while the worker was gone. Other respondents have already observed problems with shift schedules disrupting the cooperative practices of subsistence harvests and processing. The potential adverse effects would be estimated to affect half of the households with mine employees, or up to 4.5 percent of households during Operations.

Effects on Sociocultural Aspects of Subsistence (Closure)

At Closure, the 30 years of employment and income associated with Construction and Operations would cease. With cessation of Mine Site Operations, the employment and income associated with the project would be limited to a very small maintenance staff. The indirect effects of mine employment and income on subsistence practices would cease.

Based on the analyses above in the section on socio-cultural effects on subsistence during the Construction and Operations phases, the loss of income would likely make it harder for subsistence users to support the equipment and operating costs of a robust subsistence lifestyle. Adverse impacts to subsistence practices from workplace enclaves, and rotational and year-round work would cease.

Throughout the life of the mine, economic multiplier effects supporting other businesses in the EIS Analysis Area are likely. This is often referred to as creating sustainable development from the exploitation of a non-renewable mineral resource. It is speculative to estimate what levels of associated private sector ancillary development would occur over the 30 years of Construction and Operations of the Donlin Gold Project and to what extent this sector would provide employment for the displaced mine workforce. Donlin Gold plans to work with communities on a Closure Social Impact Assessment during the 3 years prior to Closure, to identify alternatives to make use of the skills and infrastructure from the Project (ARCADIS 2013a). Similarly, it is speculative to estimate public sector spending on education, health care, and public works at that time. There would be a period of adjustment, but many households would have reached a higher standard of living for nearly a generation by the time of Closure.

Based on comments on the Draft EIS, additional analysis was conducted regarding socio-economic effects of early mine closure. The regulatory standards for reclamation would apply at any time, for early or planned closure at the end of the mine life. Depending on how many years the mine has operated, early closure may result in more abrupt socioeconomic impacts. For example, if the mine operates for fewer years, the employees would have fewer years of employment and income, and would accumulate less economic benefit. Multiplier effects on other economic enterprises would have fewer years to take hold.

The sociocultural impacts to subsistence during Closure would include the loss of income to invest in subsistence practices, perhaps partially offset by other economic growth activities and planning for economic diversification at Closure. At the same time, adverse impacts from out migration, shiftwork, and year-round employment would cease.

3.21.6.3.2 TRANSPORTATION CORRIDOR

This subsection describes estimated impacts to subsistence fish and wildlife resources affected by the Transportation Corridor facilities and activities in routine construction and operations activities. This section relies on conclusions found in Section 3.12 Wildlife and Section 3.13 Fish and Aquatic Resources. The potential effects of fuel spills are addressed separately in Section 3.24, Spill Risk.

In order to estimate impacts to access to subsistence uses, community use areas for the following communities were reviewed for overlaps with the barging corridor, Bethel Port, and the Angyaruaq (Jungjuk) Port and mine access road:

- Central Kuskokwim: Stony River, Sleetmute, Red Devil, Georgetown, Crooked Creek, Napaimute, Chuathbaluk, Aniak, Upper Kalskag, Lower Kalskag (CL Brown et al. 2012; Brown et al. 2013).
- Lower-Middle Kuskokwim: Tuluksak, Akiak, Akiachak, Kwethluk, Bethel, Oscarville, Napaskiak, and Napakiak (Brown et al. 2013; Ikuta et al. 2014; Runfola et al. 2017).
- Lower Kuskokwim: Tuntutuliak, Eek, and Quinhagak (Ikuta et al. 2016)

As discussed below, many communities reported using a narrow corridor along the Kuskokwim River for fall moose and large mammal hunting, as well as berry picking, including the areas of the Angyaruaq (Jungjuk) Port and the lower mine access road (CL Brown et al. 2012; Brown et al. 2013; Ikuta et al. 2014; Ikuta et al. 2016; Runfola et al. 2017).

Communities from Crooked Creek to the mouth of the Kuskokwim River use the mainstem for subsistence fishing for salmon and for non-salmon species. Bethel and nearby communities, such as Oscarville, were reported to fish in the vicinity of the Bethel Port.

Effects on Subsistence Resources (Construction and Operations)

Under Alternative 2, Construction and Operations of the Bethel Port site,, Angyaruaq (Jungjuk) Port site, mine access road, and airstrip would result in three possible mechanisms of ongoing direct impacts to subsistence resources:

- habitat loss associated with the physical footprint of the mine road, airstrip, and ports;
- disturbance and displacement of fish, birds, and terrestrial and marine animals due to human activity such as barge and vehicle traffic; and
- fugitive dust deposits on plants used for subsistence.

Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

Subsequent paragraphs estimate the likely effects of these activities.

Habitat Loss: Construction and Operations of the Angyaruaq (Jungjuk) Port, mine access road and airstrip, would impact a small amount of terrestrial mammal habitat. The loss of habitat to these facilities would be small compared to the total amount of similar habitat available in the area. Fugitive dust would affect a corridor along the mine access road. Section 3.10 Vegetation noted that: "The extent [of fugitive dust impacts] would be within areas adjacent to roads with vehicle traffic or in unpaved surface areas, and within the dust emissions areas, with highest concentrations of dust closest to the source." Behavioral disturbance would likely be greater during the Construction Phase than from vehicle traffic during the Operations Phase, but the number of animals affected would probably be small during either phase given the limited area affected (Section 3.12.3, Wildlife).

Loss of habitat would affect resources used by the residents of Crooked Creek and other Central Kuskokwim communities in the vicinity of the mine access road and port site primarily for harvesting berries and other plants (see Figure 3.21-63 above).

Disturbance and Displacement of Fish: Disturbance from river barge and ocean barge traffic on the Kuskokwim River would affect subsistence fish resources. River barge operations under Alternative 2 would represent an increase over the estimated baseline of 68 round trips above Bethel, by 89 annual barge tow round trips during the Construction Phase and 122 during the Operations Phase (Table 3.21-26). Additionally, Project-related barges would be in a larger configuration and would typically travel farther upstream than the baseline barge traffic.

Table 3.21-26: Annual River Barge Traffic: Alternative 2

Project Phase	Activity	Number of Round Trips Per Season[a]
--	Estimated Baseline	68
Construction	Cargo to Angyaruaq/Jungjuk	50[b]
	Pipeline materials for Devil's Elbow above Stony River	20[c]
	Fuel	19[d]
	Total Project-related	89
Operations	Cargo	64[e]
	Fuel	58[e]
	Total Project-related	122

Notes:
a Baseline barge traffic typically consists of one or two 40-ft by 160-ft barges with a pusher tug. Project related cargo tows would consist of a tug pushing four 44-ft by 150-ft barges. Project-related fuel tows would consist of a tug pushing four 44-ft by 165-ft
b Total would be 200 trips over four years. Exact distribution by year would be determined during final design.
c During first two years of pipeline construction.
d Average: actual number would range from 9 to 29 annually.
e Figure represents peak year. For cargo barging, Year 7 of Operations is modeled to be the peak year and the barge trips would be reduced in early and late years. For fuel barging, Year 20 of Operations is modeled to be the peak year and the barge trips would be reduced in early and late years.

Source: SRK 2013a

Section 3.13.3.2.2 describes the potential impacts to fish and aquatic resources along the Transportation Corridor. Along the Kuskokwim River, anticipated impacts to fish and aquatic resources would be primarily associated with hydraulic forces from vessel-generated wakes

and propeller wash in certain confined and shallow segments of the navigation channel. Depending on several considerations, hydraulic forces from barge traffic could result in:

- Shoreline erosion and water quality degradation;
- Fish displacement and stranding where channel segments at select shoreline locations having a low-gradient;
- Habitat degradation from riverbed scour; and
- Possible injury or mortality of egg, larval, or juvenile fish life stages that encounter propeller blades or shear forces in the propeller flow field in the water column or along the river bed.

Along the mine access road and at the port site, risks to fish and aquatic resources would be associated with construction and operation of roadways, bridges, culverts, and shoreline infrastructure. In the vicinity of these features, changes to the character of aquatic habitat and water quality would be noticeably altered resulting in impacts on anadromous and resident fish populations and invertebrate communities that would persist for the life of the project. At certain locations along the mine access road, constructed road culverts could become periodically blocked. This could result in infrequent barriers that obstruct fish passage until flows and fish passage conditions are properly restored. Habitat alteration and population-level reductions of subsistence resources could cause subsistence users to harvest in other areas or focus on different resources.

Section 3.5, Surface Water Hydrology, provides more detailed analysis of impacts related to barging and differences in barging among the alternatives.

Ocean-going barge traffic from the mouth of the Kuskokwim River to Bethel would affect subsistence fish resources, but to a lesser degree than the river barges. Project-related ocean barges would make 30 round trips annually to Bethel during the Construction Phase and 26 round trips annually during the Operations Phase. In addition, the Kuskokwim River is considerably wider below Bethel, which allows for attenuation of barge wakes, compared to the river width upstream of Bethel.

Disturbance and Displacement of Marine Mammals: The potential effects on marine mammal subsistence resources would largely be limited to behavioral disturbance and short-term displacement of seals in the lower Kuskokwim River (Figure 3.21-64, Figure 3.21-28). Marine mammals are not common in the Kuskokwim River above Kuskokwim Bay, so noise disturbance during construction of improvements to the Bethel Port site would not likely disturb many marine mammals. Ocean-going fuel barge traffic from Dutch Harbor (14 round trips per year) and cargo traffic (12 round trips per year) to Bethel would traverse marine mammal habitat in Kuskokwim Bay, but behavioral disturbance of individual marine mammals would be a “short-term disturbance or temporary displacement as the barge passes by”(Section 3.12.3.2.2, Wildlife, Marine Mammals).

Disturbance and Displacement of Birds: As discussed in more detail in Section 3.12.3.2.3, barge traffic could affect birds through visual or noise disturbance and other mechanisms. Barge traffic may disturb foraging and nesting along the shores, although some habituation to disturbance is possible. That section concluded: “Barge traffic would mainly affect waterbirds

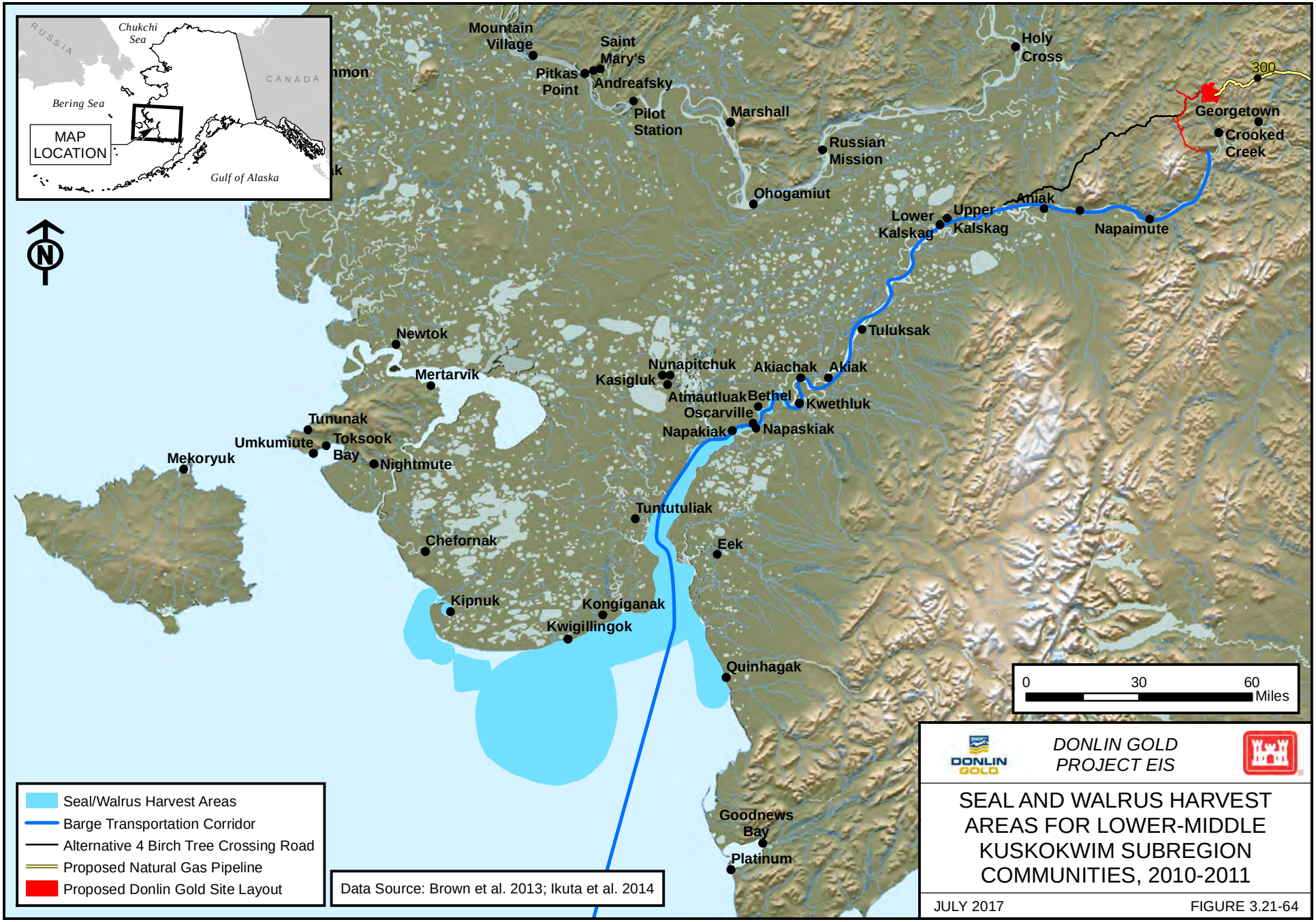
using the Kuskokwim River; their wakes could cause a noticeable change in behavior and may affect reproduction if nests are affected by erosion or large waves."

Disturbance and Displacement of Terrestrial Mammals: There is limited published literature regarding terrestrial mammal response to barge noise in particular, although information is available on response of terrestrial mammals to sounds. As noted in Section 3.12.3 Wildlife, moose are relatively tolerant and adapt to human activity. Existing traffic on the Kuskokwim River includes a larger number of smaller, high horsepower boats, which generate larger wages and noise. This does not preclude successful use of these boats hunting for moose along the river bank in fall time. Residents have observed moose coming out into the open and crossing the river only after existing barge traffic has passed and the sounds and wakes have abated, a period which may last tens of minutes or more depending on the barge load and direction of travel (URS 2014e, Appendix B, the Scoping Report). A comment on the Draft EIS suggested that due to barge noise, moose may abandon small islands in the Kuskokwim River, where they sometimes can be found. Section 3.12.3, Wildlife, concludes that the increased frequency of disturbance due to barge and other vessel traffic during the Construction Phase may deter animals from using habitats and moving between different parts of their range during the open water season. This disturbance-related displacement may make it more difficult for terrestrial mammals to be hunted from the river, which would have an adverse effect for subsistence hunters. There is potential for some large animals such as moose to habituate to the noise and increased presence of barge traffic over time; however, animals like moose are unlikely to change their patterns of crossing the river in response to barges, and the increased frequency of barges may restrict moose crossing and change moose behavior during the shipping season (Section 3.12.3.2.1).

Fugitive Dust Deposits: As described in Section 3.10.3 Vegetation, fugitive dust emissions are a by-product of the Construction and Operations of the mine access road. Dust created by road traffic during Construction and Operations has the potential to collect on vegetation in the vicinity of the dust sources, and windblown dust could affect vegetation beyond the source, however, these effects would diminish with distance and with effective dust control measures on the road.

Effects on Subsistence Resources (Closure)

During the Closure Phase of Alternative 2, effects from changes in subsistence resources would be at much lower levels as project support activity at the Angyaruaq (Jungjuk) Port site, mine access road, and airstrip would decrease. At the Angyaruaq (Jungjuk) Port site, the sheet piling dock and staging yard would be dismantled, with only a minimal barge landing remaining in place. The mine access road and airstrip would remain in place during the Closure Phase to support reclamation, monitoring, and eventually water treatment plant activities at the mine site. The road and airstrip would see periodic use associated with monitoring activities, but much lower than during operations, which would reduce the impact to local subsistence resources, compared to the Operations Phase (Section 3.12.3.2.2, Wildlife). Some supplies and fuel would be barged up to the Angyaruaq (Jungjuk) Port periodically but the numbers of barges needed would be a fraction of the Operations Phase, more similar to baseline conditions. Project-related barge traffic to the EIS Analysis Area would be infrequent following Closure which would reduce the disturbance and displacement of river-corridor fish, marine mammal, and terrestrial mammal subsistence resources on the Kuskokwim River to near baseline levels.


MAP LOCATION
Chukchi Sea
Bering Sea
Gulf of Alaska
RUSSIA
CANADA
Mountain Village
Saint Mary's
Pitkas Point
Andreafsky
Pilot Station
Marshall
Russian Mission
Ohogamiut
Holy Cross
300
Georgetown
Crooked Creek
Aniak
Napaimute
Lower Kalskag
Upper Kalskag
Tuluksak
Akiachak
Akiak
Bethel
Kwethluk
Oscarville
Napaskiak
Napakiak
Nunapitchuk
Kasigluk
Atmautluak
Newtok
Mertarvik
Tununak
Umkumiute
Toksook Bay
Nightmute
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Goodnews Bay
Platinum
0
30
60
Miles
Seal/Walrus Harvest Areas
Barge Transportation Corridor
Alternative 4 Birch Tree Crossing Road
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Data Source: Brown et al. 2013; Ikuta et al. 2014
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SEAL AND WALRUS HARVEST AREAS FOR LOWER-MIDDLE KUSKOKWIM SUBREGION COMMUNITIES, 2010-2011
JULY 2017
FIGURE 3.21-64

Effects from Changes in Access to Subsistence Resources (Construction and Operations)

Mine Access Road and Angyaruaq (Jungjuk) Port Site. Under Alternative 2, Construction and Operation of the mine access road and the Angyaruaq (Jungjuk) Port site would displace access and use of a small portion of the harvest area used by Crooked Creek residents to gather plants and berries (Figure 3.21-16). An estimated 1-mile disturbance buffer around the port site and on either side of the initial segment of the mine access road would represent about 6 square miles of the total mapped Crooked Creek berry and plant use area of 122 square miles or about 5 percent. Other communities do not typically use the area of the road, but they do travel along the Kuskokwim River, including the port site, while hunting for moose along the riverbanks (Figure 3.21-60 above), and these hunts would be disturbed by activities at the Angyaruaq/Jungjuk Port site.

Construction and Operations of the Angyaruaq (Jungjuk) Port site would disturb and displace access to one known fish camp located just below the mouth of Angyaruaq (Jungjuk) Creek currently used by residents of Crooked Creek (Figure 3.21-65). Fish camps may be difficult to relocate, as alternative sites may be more difficult to obtain due to land ownership patterns. For individuals whose fish camp is located on a Native Allotment, the Native Allotment cannot be relocated and loss of use would impose a greater hardship.

Fishing sites located above the mouth of Angyaruaq (Jungjuk) Creek, and in the Great Bend of the Kuskokwim River, are unlikely to be affected by operation of the port site (see Figure 3.21-65 and Figure 3.21-17). These include drift net and set net sites, as well as a fish wheel site. However, downstream of the Angyaruaq (Jungjuk) Port site, several mapped set net sites and drift netting areas would be affected by the barges arriving at the port (see Figure 3.21-65). For discussion of displacement of access due to barge traffic, see the section on Displacement of Access Due to River Barge Traffic below.

Bethel Port Site: Bethel Native Corporation noted the importance of the Bethel Port Site area in comments to the Corps regarding the Knik Construction permit application.

> The "choke point" is magnified because the east bank of the Kuskokwim River, located opposite the proposed dock, is shallow and will become increasingly more shallow due to the natural flow of the river and be accelerated by Knik's proposed dock expansion into the River. This site on the east bank is a traditional subsistence fishing site for BNC shareholders. The erosion caused by Knik's project would negatively impact BNC lands in the vicinity, including BNC lands and Indian trust lands on the east back through severe scouring or shoaling… (Bethel Native Corporation 2014).

Bethel residents fish for salmon and freshwater fish species along a large segment of the Kuskokwim River below and above Bethel. Additional harvest areas are found upriver in the Kwethluk and Kisaralik rivers, along the Kuskokwim River between Kalskag and Aniak, near Napaimute, and in the Holitna River. Harvest areas were also located close to Toksook Bay, Hooper Bay, and Quinhagak, and on the Lower Yukon (Figure 3.21-27). Activities at the Bethel Port site, adjacent to the existing Knik Construction Bethel Yard Dock (a connected action, see Chapter 1, Section 1.2.1, Connected Actions), would displace use of a small portion of this larger fishing area.

Additional analysis found in Section 3.5, Surface Water Hydrology, indicated that the impacts on river hydrology from the Bethel Yard Dock would be limited. According to that analysis, the

new dock would extend 25 feet into the river from the current shoreline, and barges would tie up parallel to the bulkhead, reducing river obstruction when compared to the current practice of barges tying up perpendicular to the landing (see Figure 3.5-30). The new bulkhead would result in a reduction to the flow area of the channel at the dock by less than 2 percent. The bulkhead would result in deflection around the structure, with a slightly increased potential for erosion and deposition at either end. Propeller wash from tugs at new and existing facilities would result in increased bed scour in the immediate vicinity of the dock. These impacts are expected to exceed historic seasonal variation, but could be minimized by BMPs for erosion control and placement of rip-rap at either end of the new bulkhead. Potential hydrological effects from the dock would be considered by the Corps when deciding whether or not to issue a permit to Knik Construction.

Subsistence fishing areas downriver from the Bethel dock would be subject to less frequent ocean barge passage (an estimated 12 cargo barges and 14 fuel barges per season) while subsistence fishing areas upriver from the dock would be subject to the frequency of river barges and effects described below. In all, the displacement of access may require some subsistence users to adjust the timing or to relocate their subsistence fishing. Alternative times and locations are available at moderate cost and effort.

Displacement of Access Due to River Barge Traffic: Wave height from river barge traffic creates the potential to displace access and use of subsistence fishing areas. According to the analysis in Section 3.5, Surface Water Hydrology:

> Potential maximum wave heights from barge traffic were calculated by BGC (2016a, 2017g) for six Kuskokwim River communities using both PIANC (1987) and Sorenson and Weggel (1984) equations. Using the closest distance from barging alignments to these communities, wave heights during upstream loaded travel were calculated to be between 0.04 and 0.21 feet (Table 3.5-30). For downstream empty travel, wave heights were calculated to be between 0.29 and 0.67 feet (Table 3.5-31) due to increased barge speed.

Analysis also showed that the greatest potential effect from downstream barge traffic would be in the vicinity of Aniak and (Upper) Kalskag (Table 3.5-31).These estimates of wave heights indicate that set nets and fish cutting rafts along the shoreline would be subject to limited disruption. More detailed drift net and set net fishing locations in the vicinity of important subsistence areas near Birch Tree Crossing, Aniak, and Chuathbaluk are shown in Figure 3.21-66A, B, and C for Central Kuskokwim river communities. A broader scale depiction of Central Kuskokwim subsistence salmon fishing locations is shown in Figure 3.21-67.

The potential for impacts is greatest when river barges pass drift nets. Drift nets are the most prevalent gear type used to harvest salmon in the Kuskokwim River because they can harvest multiple salmon species, with flexible fishing schedules, and fishing from the village instead of a fish camp (Ikuta et al. 2013). Of the 878 households surveyed in Kuskokwim communities in 2012, 79 percent reported harvesting salmon with drift gill nets and 12 percent reported using set nets. In Aniak, where the greatest potential impact could be felt from downriver barge traffic, 60 out of 89 households reported using drift nets while six households reported using set nets. At both Lower and Upper Kalskag, no household reported using a set net (Fall et al. 2014). Residents of Upper Kalskag report that current levels of barge traffic have already influenced the way they fish. Fishers either try to drift before the barge passes or wait until well after the barge has passed (Ikuta et al. 2013).

Intermittent periods of interference with drift nets would likely occur during barge season, not exceeding a couple of hours surrounding the barge tow passage. While this interference would affect access and travel on the river during the navigable season, the interference would be most pronounced in the locations where narrow reaches of the river overlap with subsistence fishing areas, namely Birch Tree Crossing, Aniak, and the Upper Oskawalik area (Figure 3.21-65 and Figure 3.21-66A and 66B). Under Alternative 2, there would be an estimated average 8-hour interval or more between barge tow passages. Taking fishing areas, narrow reaches of the river, and intermittent barge disturbance together, it is likely that for some fishing families the effects will be of greater intensity, requiring changes in scheduling of fishing activities or relocation of fishing areas. Traditionally, salmon harvest effort is concentrated in areas known to be productive, with streambed conditions that are conducive to subsistence fishing effort, and readily accessible from the fishers residence. However, salmon runs return along the Kuskokwim River from the mouth to the spawning streams, so alternative fishing locations are available. The necessity of rescheduling around barge tow transits or relocating to alternative fishing locations would likely impose moderate costs and effort.

Commenters on the Draft EIS asked for specific analysis of the interaction between project barging activities and disturbance with the conservation restrictions on Chinook salmon fishing. Local residents have pointed out that subsistence Chinook salmon fishing has been restricted on the Kuskokwim River since 2012 due to weak run returns (Section 3.21.5.5; Runfola et al. 2017). These have included rolling closures and periods with gear restrictions. Subsistence harvests of Chinook salmon have been reduced dramatically, while escapements have begun to improve. The restrictions have been implemented as rolling periods, corresponding to periods of concentrated seasons of Chinook salmon passage in portions of the Kuskokwim River starting at the mouth and proceeding upriver. These restrictions are intended to allow the majority of the Chinook run to pass through without intense harvest pressure. As noted in Runfola et al. (2017), subsistence fishing efforts following the rolling period of restrictions are focused on other salmon species, despite the fact that Chinook salmon are a preferred subsistence food and the early season is more conductive to preserving salmon by drying and smoking. Restrictions on barge traffic during or just following the rolling periods of restrictions on Chinook harvest would not increase the Chinook salmon harvest. Residents noted that if fishing is unrestricted such that people can conduct subsistence fishing anytime, the likelihood of conflicts would be reduced (URS 2014e).

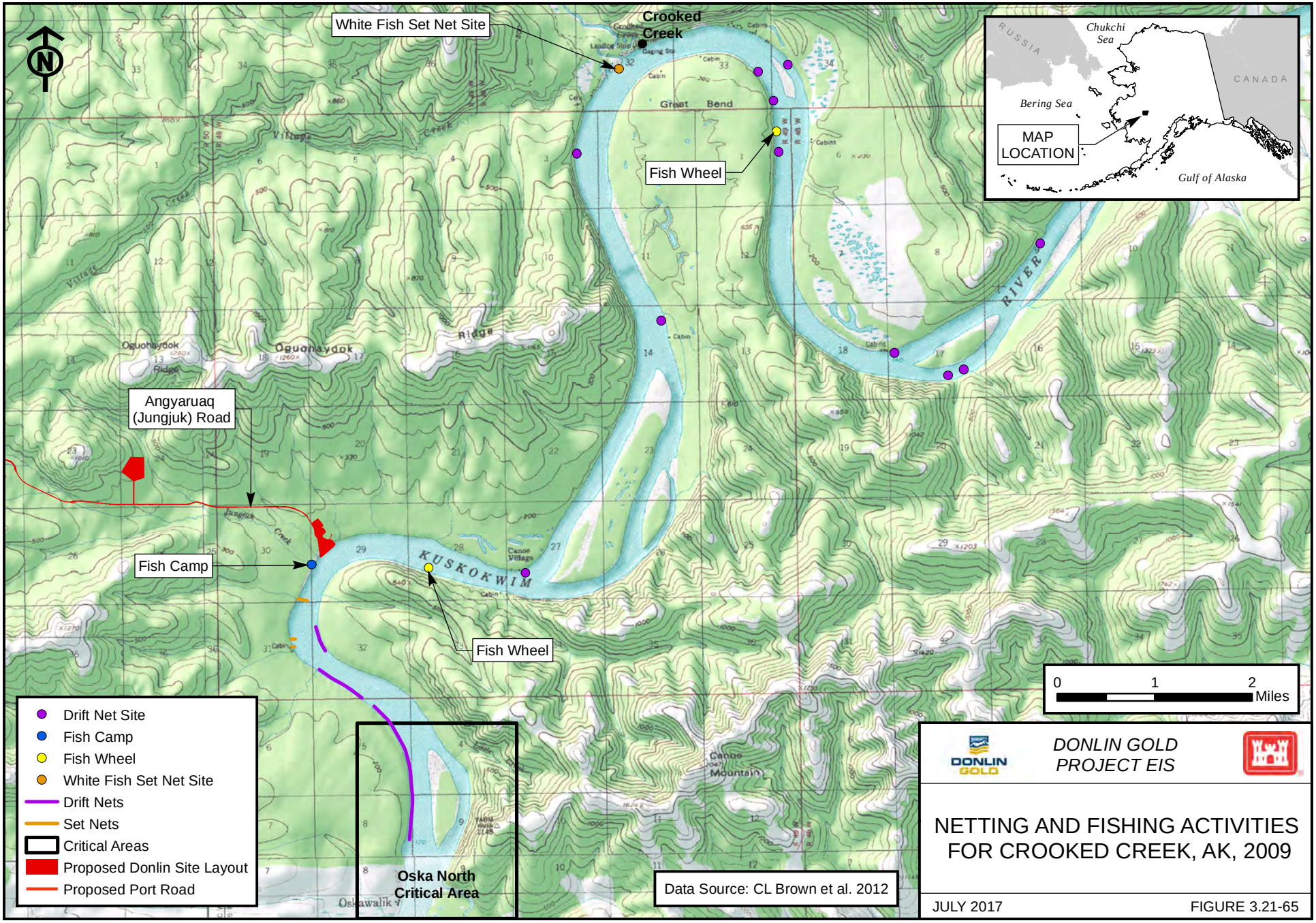
Barging could potentially affect access to or displace subsistence fishing by generating propeller wash and wakes that could interfere with fish nets, fish cutting rafts or fish wheels, and processing rafts, or erode riverbanks and affect fish camp sites. River barge traffic could potentially displace use of fish camps along the Kuskokwim River banks. Use of fish camps in western Alaska has been changing in recent decades for a number of complex interacting ecological, economic, and social reasons (Wolfe and Scott 2010). In some communities, many residents have stopped going to fish camp because of employment or lack of available land to establish new camps (Ikuta et al. 2013). Analysis to date identified only a few instances in which displacement of fish camps is likely to occur, for example, at the location of the Angyaruaq (Jungjuk) Port site (see Figure 3.21-65). Relocation of fish camps can be difficult if they are located on Native Allotments which are private property held in trust with fixed locations. For some communities, harvest areas for non-salmon fish species such as trout and various whitefish species are the same as those for salmon, so the effects of barge traffic on the harvest of freshwater fish would be similar. It is important to note that the harvest of freshwater fish

takes place throughout the year, and harvest locations for freshwater species are more diverse than those for salmon. For these reasons, the effect of barge traffic on the annual harvest of freshwater fish would be lower than for salmon, since freshwater fish harvests also occur in lakes and tributaries, and during times of year, unaffected by river barge traffic.

Several approaches are incorporated into river barge fleet design and operations plans to reduce potential impacts of vessel traffic. These include maximizing cargo capacity to minimize the number of trips and implementing a communication strategy that keeps local communities informed of schedules and status of barge traffic location. An example would be that information on barge locations and speed would be available on the Internet, and net locations would be incorporated into electronic river charts to reduce incidents of damage (AMEC 2013). Results of discussions with local residents experienced in navigation on the Kuskokwim River would be incorporated into the design of barging operations and guidelines (Table 5.2-1). Donlin Gold has committed to two subcommittees, the Barge Subcommittee and Subsistence Subcommittee, which would act in parallel to engage and inform local communities (Table 5.2-1). These subcommittees would be managed under purview of the Donlin Advisory Technical Review and Oversight Committee (DATROC).

Displacement of Access Due to Ocean Barge Traffic: Access to fishing areas below Bethel, used by Lower-Middle Kuskokwim subregion (Figure 3.21-68) and Lower Kuskokwim subregion communities are not expected to see much disruption from ocean barge traffic because of the wider channel and because of a lower volume of ocean-going barge traffic. Ocean-going fuel barge traffic from Dutch Harbor would amount to 14 round trips per year and cargo traffic would involve 12 round trips per year to Bethel, for a total of 26 round trips transiting the lower river. This represents a more limited frequency than the in-river barge traffic from Bethel to Angyaruaq (Jungjuk) Port.

Displacement of Access to Terrestrial Mammal Subsistence Hunting: Subsistence hunting access along the main stem of the Kuskokwim River would not be physically or legally restricted by project barge traffic. However, barge activity may disturb and displace upland subsistence resources like moose, thereby limiting effective access. Further, barge traffic may make hunting by boat along the mainstem of the Kuskokwim River more difficult. Local residents have expressed differing opinions about the effect of increased barge traffic on moose in the riparian environment, and therefore on potential displacement of their ability to successfully hunt moose in this zone as they have done historically. As noted above, some hunters who hunt along the river have expressed the opinion that more frequent barge traffic would create disturbances keeping the animals away from the riverbank, thus making hunting more difficult, while others have said that moose become habituated to the barge sound and would not be displaced from the riverbanks. Locals who use the mainstem of the river as a way to reach more distant locations away from the river, such as the Holokuk and Oskawalik Rivers, do not think barge traffic would have an effect on moose behavior or their subsistence harvest of moose (URS 2014e). The effects from changes in access to subsistence resources from increased barge traffic would be limited to the mainstem of the Kuskokwim River.



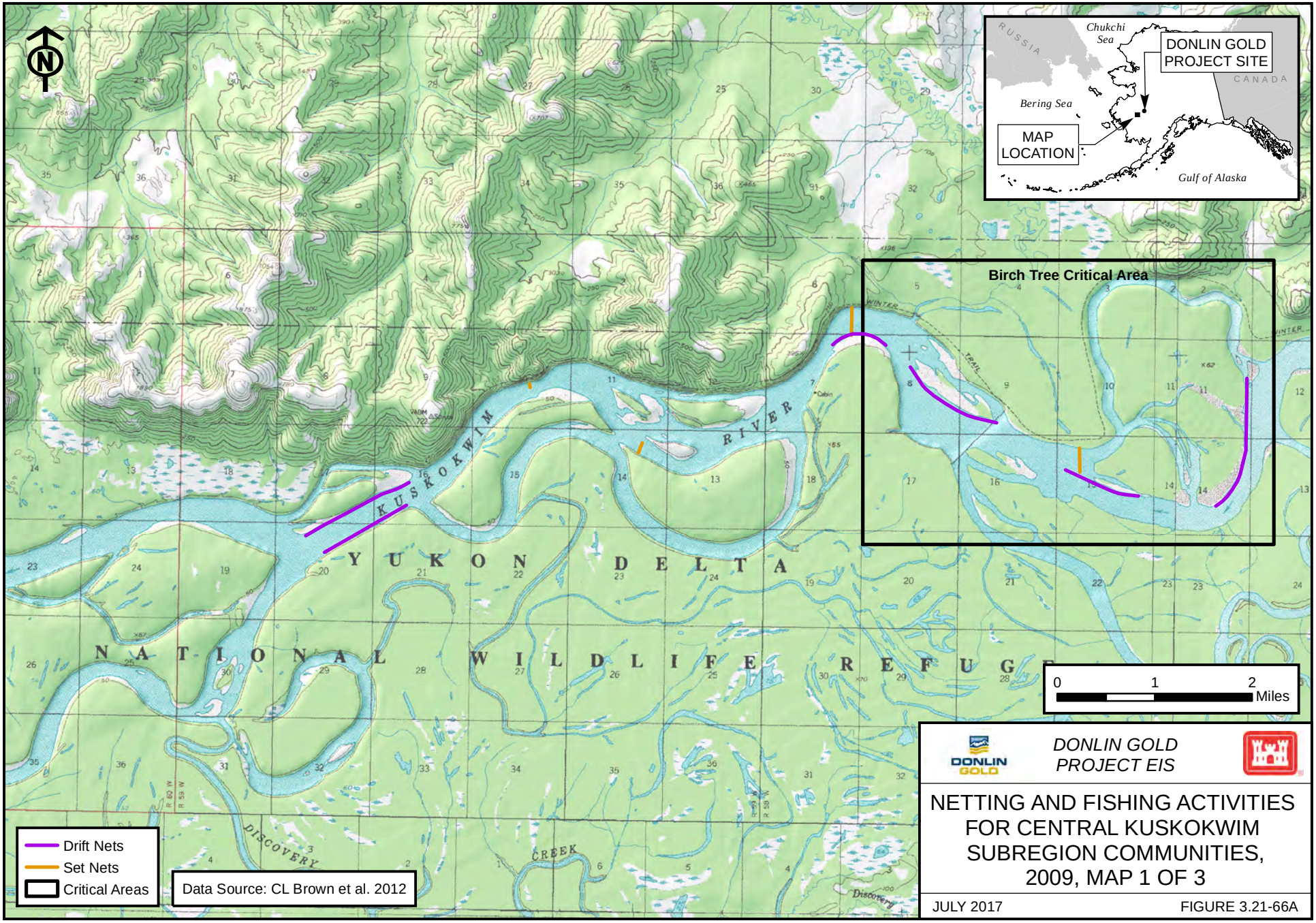
DONLIN GOLD

DONLIN GOLD PROJECT EIS

NETTING AND FISHING ACTIVITIES FOR CROOKED CREEK, AK, 2009

JULY 2017

FIGURE 3.21-65

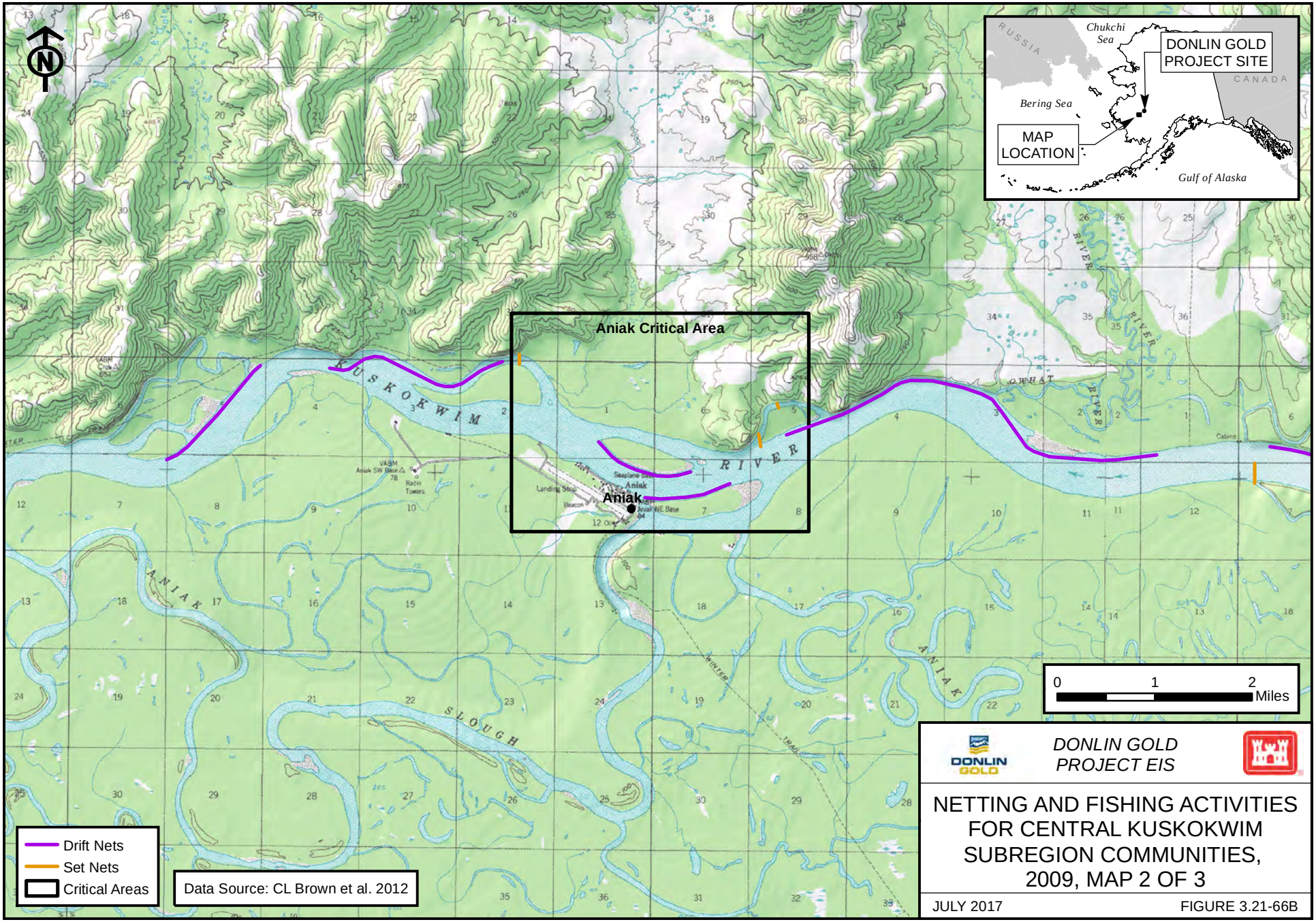


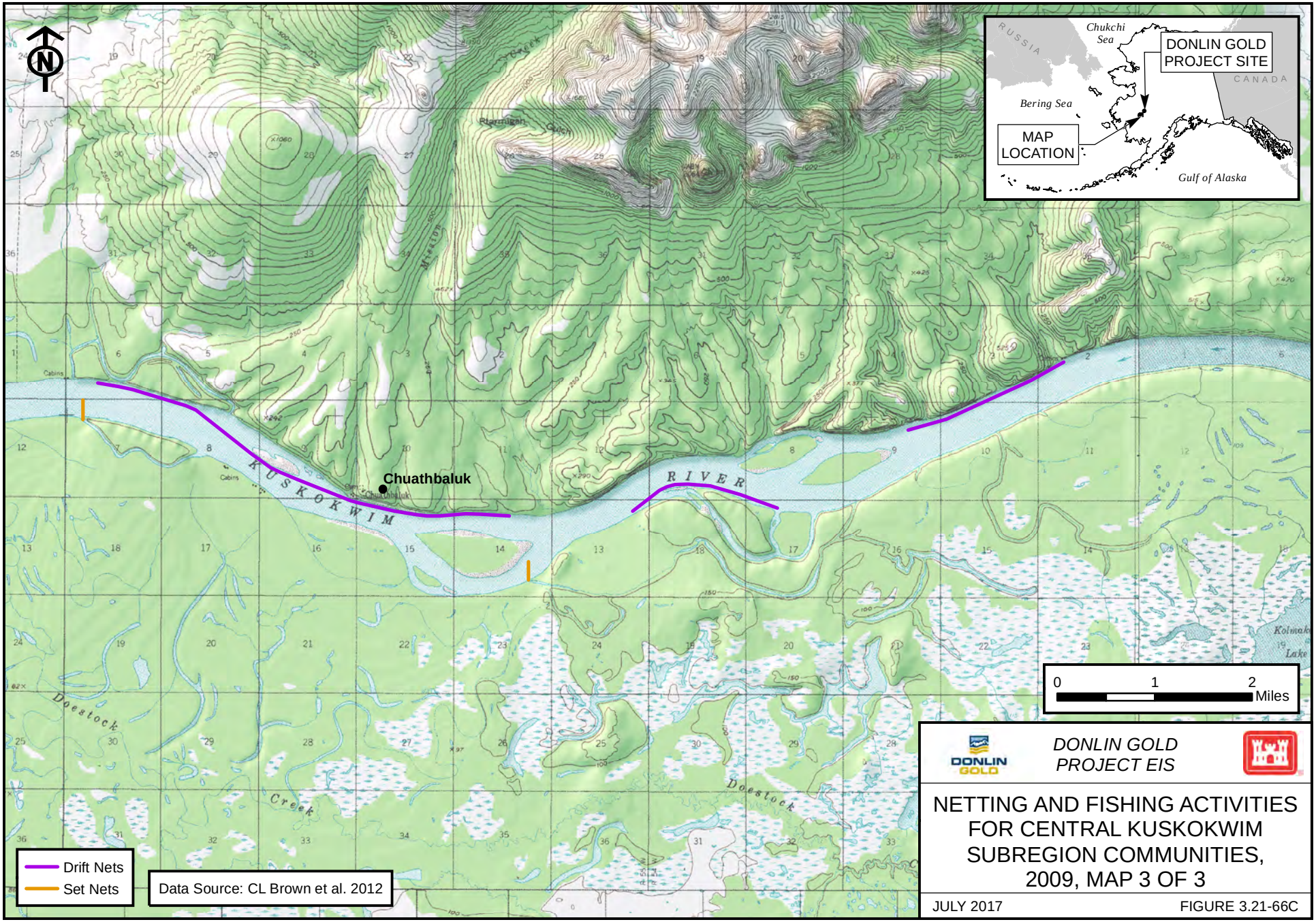
DONLIN GOLD PROJECT EIS

NETTING AND FISHING ACTIVITIES FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009, MAP 1 OF 3

JULY 2017

FIGURE 3.21-66A


Aniak Critical Area
Aniak
KUSKOKWIM RIVER
ANIAK SLOUGH
WINTER ISLAND
OWHAT RIVER
Chukchi Sea
RUSSIA
DONLIN GOLD PROJECT SITE
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
0 1 2 Miles
Drift Nets
Set Nets
Critical Areas
Data Source: CL Brown et al. 2012
DONLIN GOLD
DONLIN GOLD PROJECT EIS
NETTING AND FISHING ACTIVITIES FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009, MAP 2 OF 3
JULY 2017
FIGURE 3.21-66B



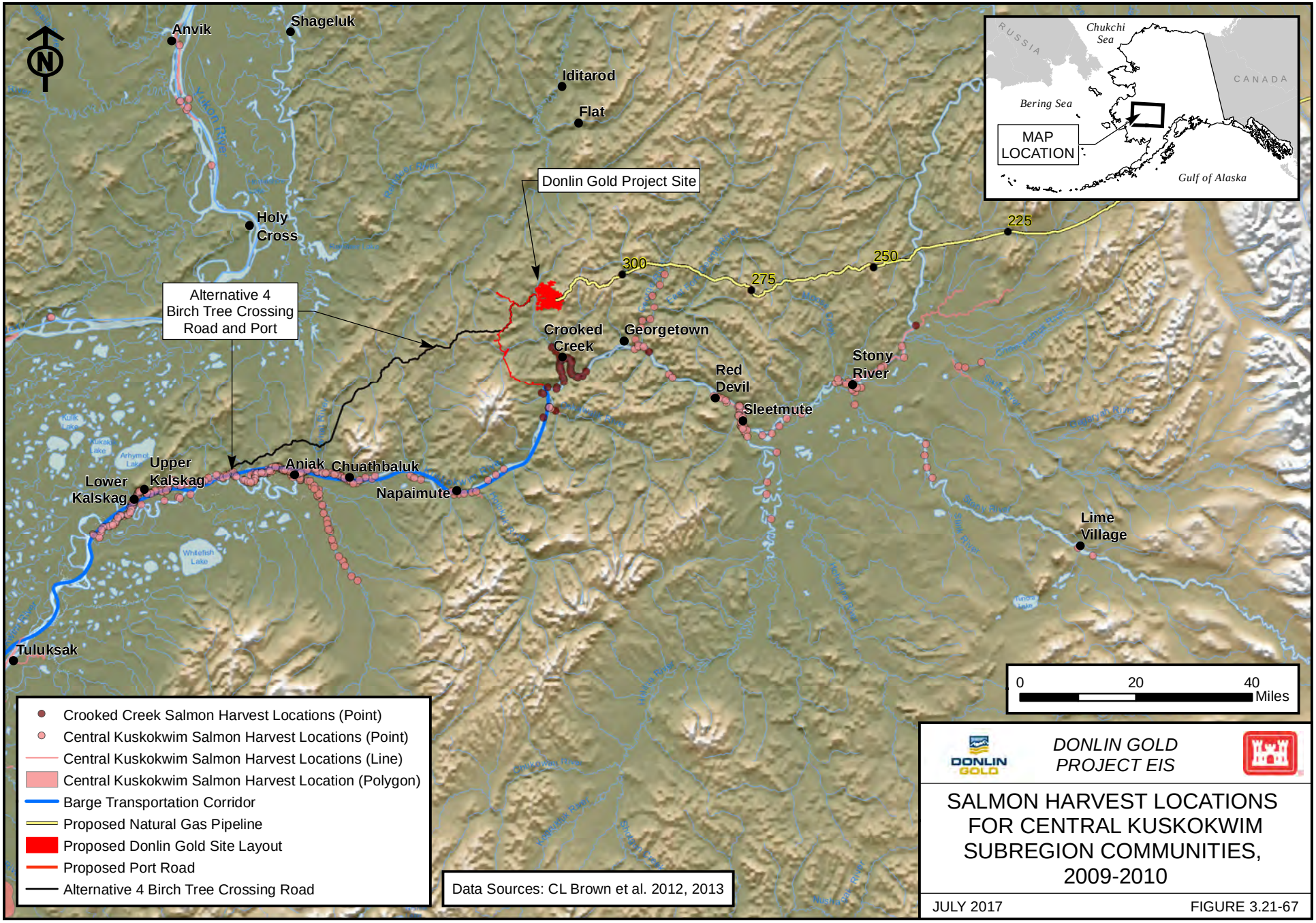
DONLIN GOLD

DONLIN GOLD PROJECT EIS

NETTING AND FISHING ACTIVITIES FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009, MAP 3 OF 3

JULY 2017

FIGURE 3.21-66C



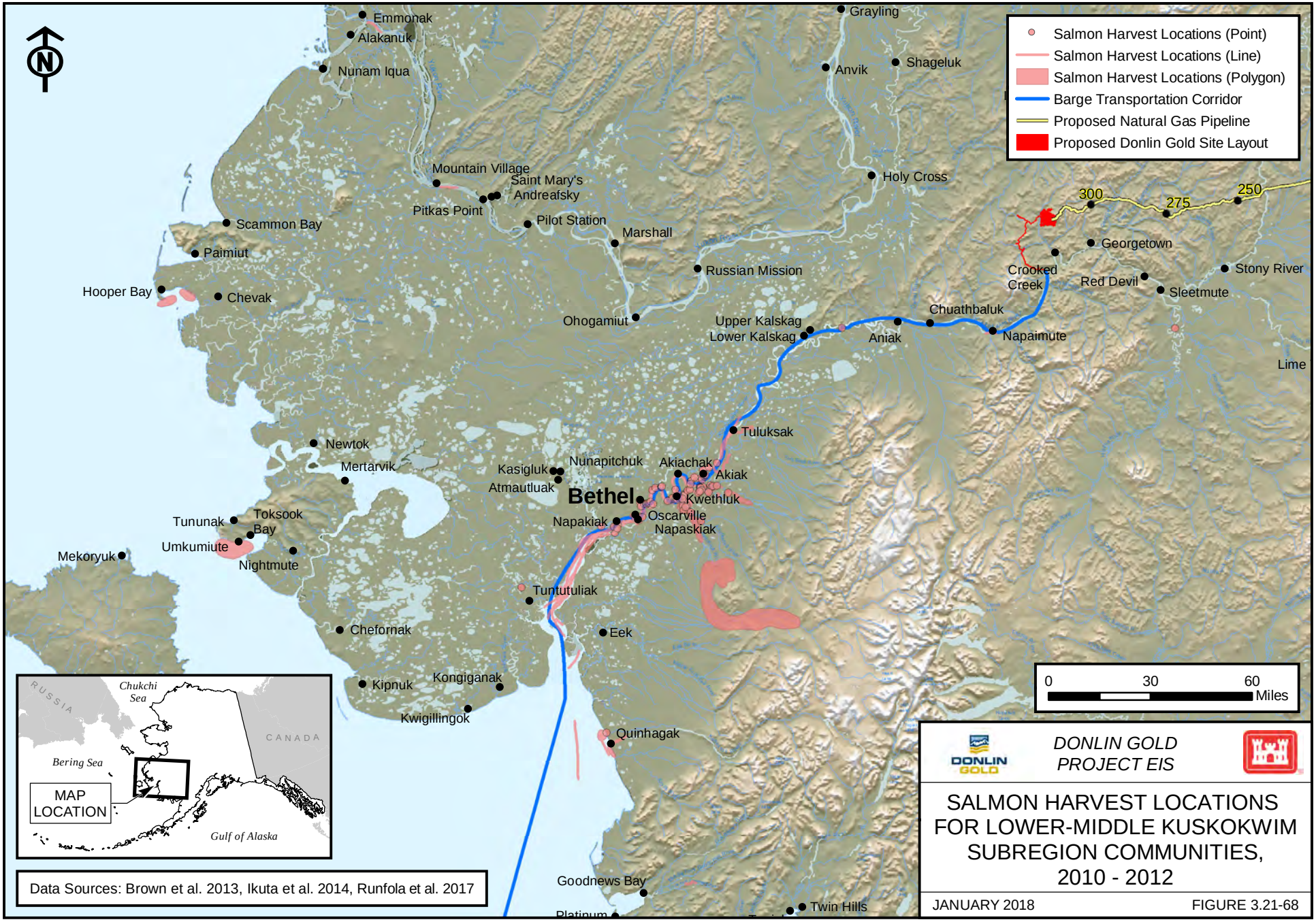
DONLIN GOLD

DONLIN GOLD PROJECT EIS

SALMON HARVEST LOCATIONS FOR CENTRAL KUSKOKWIM SUBREGION COMMUNITIES, 2009-2010

JULY 2017

FIGURE 3.21-67


Salmon Harvest Locations (Point)
Salmon Harvest Locations (Line)
Salmon Harvest Locations (Polygon)
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Emmonak
Alakanuk
Nunam Iqua
Grayling
Anvik
Shageluk
Holy Cross
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Marshall
Scammon Bay
Paimiut
Hooper Bay
Chevak
Russian Mission
Ohogamiut
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Crooked
Creek
Red Devil
Sleetmute
Stony River
Georgetown
300
275
250
Lime
Tuluksak
Akiachak
Akiak
Kwethluk
Oscarville
Napaskiak
Napakiak
Nunapitchuk
Kasigluk
Atmautluak
Bethel
Newtok
Mertarvik
Tununak
Toksook
Bay
Umkumiute
Nightmute
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
Goodnews Bay
Twin Hills
Platinum
0
30
60
Miles
RUSSIA
Chukchi
Sea
CANADA
Bering Sea
MAP
LOCATION
Gulf of Alaska
Data Sources: Brown et al. 2013, Ikuta et al. 2014, Runfola et al. 2017
DONLIN GOLD
DONLIN GOLD
PROJECT EIS
SALMON HARVEST LOCATIONS
FOR LOWER-MIDDLE KUSKOKWIM
SUBREGION COMMUNITIES,
2010 - 2012
JANUARY 2018
FIGURE 3.21-68

Effects on Access to Subsistence Resources (Closure)

During the Closure Phase, activity at the Angyaruaq (Jungjuk) Port site, mine access road, and airstrip would decrease to very intermittent use. At the port site, the sheet piling dock would be removed and the mine access road and airstrip would remain in place to support reclamation and monitoring activities at the Mine Site. If local use of the access road is allowed after closure, access to subsistence resources would increase. Because there are currently few roads in the area, it is likely that local residents may want to use the port and road to access subsistence resources.

Supplies and fuel would continue to be barged to the port site on a periodic basis but the number of barges would be much smaller than during Operations. This would reduce the levels of impact to access for subsistence fishing in the Kuskokwim River and reduce the disturbance to subsistence hunting for terrestrial mammals along the river corridor as well.

Effects on Competition for Subsistence Resources (Construction; Operations; and Closure)

The effect of Construction, Operations, and Closure of the Transportation Corridor on competition for subsistence resources would be similar in intensity to those of the Mine Site. It is likely that local residents would provide much of the workforce for Construction and Operation of the Transportation Corridor. During the Operations Phase, approximately 100 workers would be needed during the 3- to 4-month shipping season. A small portion of the transportation-related workforce may elect to take up residence in Bethel, but this would be a small increment in relation to the large population of this regional center community. Closure of the mine would reduce the workforce even further and without regular employment it is unlikely that workers who moved to the area during Operations would remain in the area. For this reason, Closure would likely further reduce the effects of competition. Effects from in-region competition for scarce subsistence resources are the same as those identified in relation to the Mine Site. Access to the Angyaruaq (Jungjuk) road may remain restricted after the mine is closed. Because there are few roads in the area it is likely that local residents may want to use the port and road to access subsistence resources. If access is increased, this could increase competition for subsistence resources in this area, although it may reduce activity elsewhere.

Effects on Sociocultural Aspects of Subsistence (Construction; Operations; and Closure)

The sociocultural effects of Construction, Operations, and Closure of the Transportation Corridor would be similar to those associated with the Mine Site. However, jobs associated with the transportation facilities and barging would be seasonal rather than year-round. It is expected that employment on barges would involve rotational shifts of two weeks on and two weeks off, during the barging season.

3.21.6.3.3 PIPELINE

This subsection describes estimated impacts to subsistence fish and wildlife resources affected by the Pipeline in routine operations. This section relies on conclusions found in Section 3.12 Wildlife and Section 3.13 Fish and Aquatic Resources. The potential effects of fuel spills are addressed separately in Section 3.24, Spill Risk.

To analyze likely impacts to access to subsistence uses, community use areas documented from Tyonek, Beluga, Skwentna, McGrath, Nikolai, Takotna, Stony River, Sleetmute and Crooked Creek were analyzed for overlaps with the Pipeline corridor (CL Brown et al. 2012; Ikuta et al. 2014; Stanek et al. 2007; Jones et al. 2015). As discussed below, overlaps were identified for Tyonek, Skwentna, McGrath, Nikolai, Stony River, and Crooked Creek.

Effects on Subsistence Resources (Construction)

Construction of the 316-mile, buried natural gas pipeline would take place concurrently in two spreads over a 2.5-year period. Spread 1 is from the Mine Site at MP 316 to the Tatina River at MP 127, and Spread 2 runs from the Tatina River at MP 127 to the Pipeline start near Beluga at MP 0. Construction would be confined to a 150-foot temporary construction ROW, along with ancillary facilities including material sites, pipe storage yards, temporary roads, temporary airstrips, and worker camps. The Pipeline would be constructed in segments so the entire length of the pipeline corridor would not be impacted by construction activities at the same time. After Construction, the ROW would be revegetated and temporary construction facilities such as culverts and bridges would be removed. Temporary access roads, shoofly roads, temporary airstrips, temporary barge landings, and material sites would be recontoured, stabilized, rehabilitated, and reclaimed. Where the vegetation mat would be stripped and stockpiled during Construction, it would be spread to facilitate natural revegetation (see Chapter 2, Section 2.3.2.3.6). No road or transportation enhancements along the Pipeline corridor would remain in place. After Construction, during the Operations Phase, vegetation clearing would occur in the 50-foot ROW (or 51.5 feet on BLM lands) every decade to support visual inspection and monitoring. Brush would be cut using a hydro-ax or similar equipment and would be shredded or chipped for use as mulch on the ROW. The Operations ROW would not be fenced.

The effects of Pipeline Construction on subsistence resource availability and abundance would result from the mechanisms of

- habitat loss, and
- disturbance of some wildlife during Construction.

Habitat loss would occur in the Pipeline Construction ROW (11,500 acres) and the facilities supporting construction, such as borrow pits, staging areas, camps, and shoofly roads (2,600 acres) (Section 3.2, Soils). The disturbance activities during the Construction Phase would generally be limited to a single construction season in any segment of the Pipeline (Sections 2.3.2.3.4 and 2.3.2.3.5, Chapter 2, Alternatives), although staging materials at temporary sites may extend activity beyond one season.

Construction activities could temporarily disturb or displace wildlife, obstruct their movement, or otherwise affect animal behavior. It is likely that Construction effects (mortality) would be on individuals and "population level effects would not be expected to be detectable" (Table 3.12-8). The potential for disruption of the seasonal movement of moose, caribou, Dall sheep, and bison, and the associated impacts to vital life stages, are of particular concern to local residents as expressed during the Scoping period and comments on the Draft EIS. However, given the short period of disruption from Construction, it is unlikely that this would directly reduce wildlife populations used for subsistence see Section 3.13, Fish and Aquatic Resources.

Section 3.13.3.2.3 covers the impacts of stream crossings and addresses the potential impacts to specific fish species, including sheefish, and the applicability of BMPs to minimize impacts.

Alterations to aquatic habitats may occur downstream of certain pipeline stream crossings and in association with withdrawals and discharges from ice road construction and pipeline testing. Pipeline construction activities could also cause behavioral disturbance of fish and other aquatic biota. Pipeline construction activities may have population-level impacts on some fish species, though population-levels would likely remain within normal variation and would be limited to the EIS Analysis Area. Small changes in the availability of some fish species could cause subsistence users to make slight adjustments to harvest patterns.

Effects on Subsistence Resources (Operations and Closure)

Following the Construction Phase, the natural gas pipeline would be buried except for two 1,300-foot long aboveground fault crossings, block valves located every 20 miles, and a pigging station located at the halfway point. The Pipeline ROW would not be fenced, so would not block wildlife passage. Vegetation would be cleared within the 50-foot ROW (or 51.5-foot on BLM lands) every 10 years to allow for maintenance and visual monitoring. Operations would have much less impact on subsistence resources than seen during the Construction Phase since there would be little activity or human presence in the vicinity of the ROW. Subsistence resources that had moved away or were displaced because of Construction would in all likelihood return.

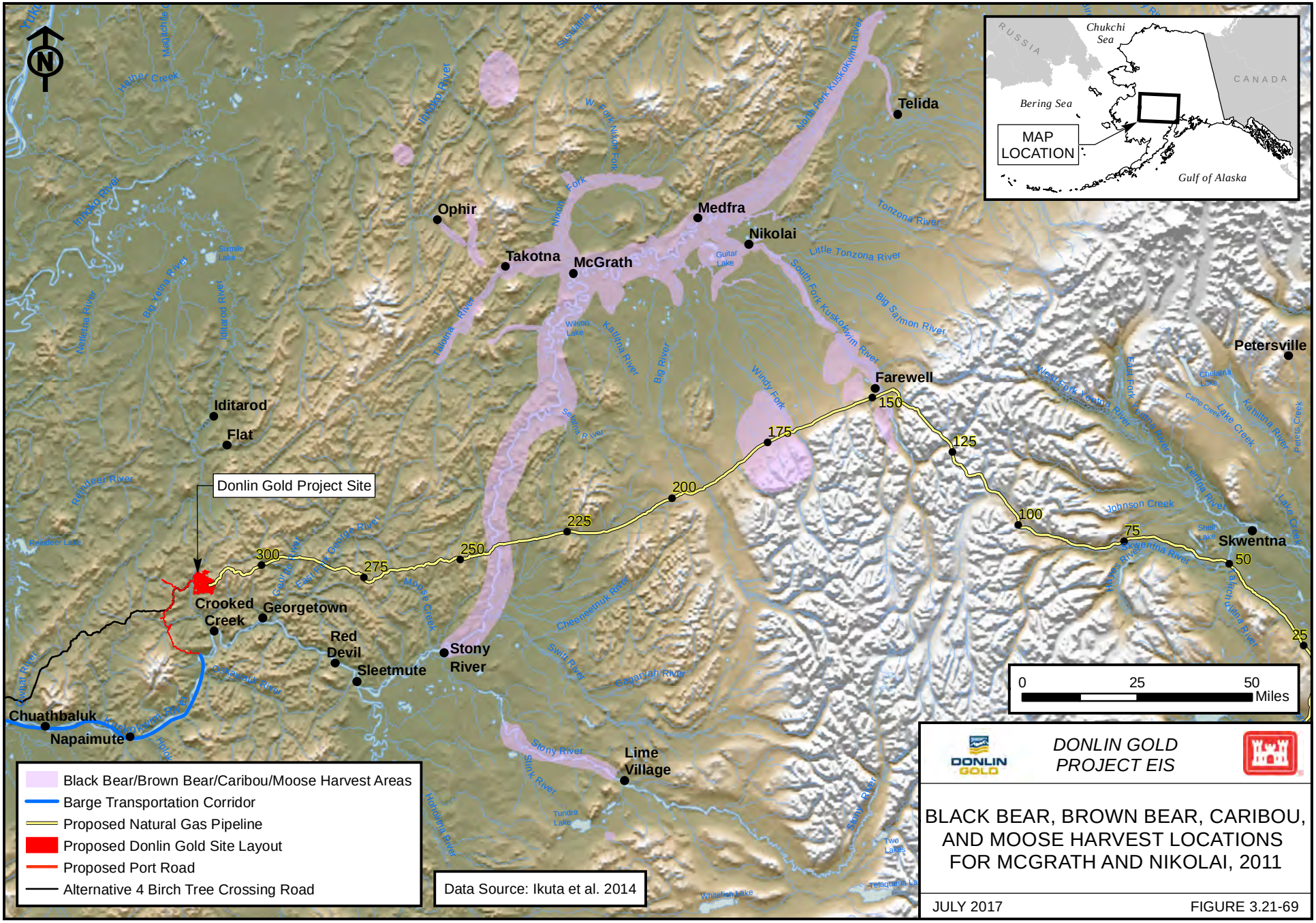
During Closure, the Pipeline would be sealed and left in place below ground with no large excavations taking place. The associated aboveground pipeline facilities would be dismantled and removed. The ROW would return to its preconstruction state. The subsistence resources would gradually return to pre-project conditions.

Effects on Access to Subsistence Resources (Construction)

Under Alternative 2, the 316-mile natural gas pipeline would traverse some portion of the subsistence use areas for several villages:

- Crooked Creek, in the George River approximately between MP 270 and MP 290 (see Figure 3.21-60 for moose)
- Stony River, between MP 235 and MP 250 (see Figure 3.21-60 and Figure 3.21-63 for moose and berry harvest areas)
- McGrath and Nikolai, in the vicinity of MP 150, MP 175, and MP 240 (see Figure 3.21-69 for black bear, brown bear, caribou, and moose harvest locations). Figure 3.21-70 displays small mammal harvest areas between MP 145 and MP 175. Figure 3.21-71 displays harvest areas for vegetation and birds at several locations between MP 150 and MP 250
- Skwentna, between approximately MP 50 and MP 75 (see Figure 3.21-72 for black bear, caribou, and moose harvest areas; Figure 3.21-73 for salmon harvest locations; Figure 3.21-74 for bird harvest areas; and Figure 3.21-75 for berries and plant harvest locations)
- Tyonek, between MP 0 and approximately MP 5 (see Figure 3.21-72 for black bear, caribou, and moose harvest areas; Figure 3.21-74 for bird harvest areas; and Figure 3.21-75 for berries and plant harvest locations).

The pipeline would not overlap with salmon fishing areas for any communities except for Skwentna (see Figure 3.21-73).



DONLIN GOLD

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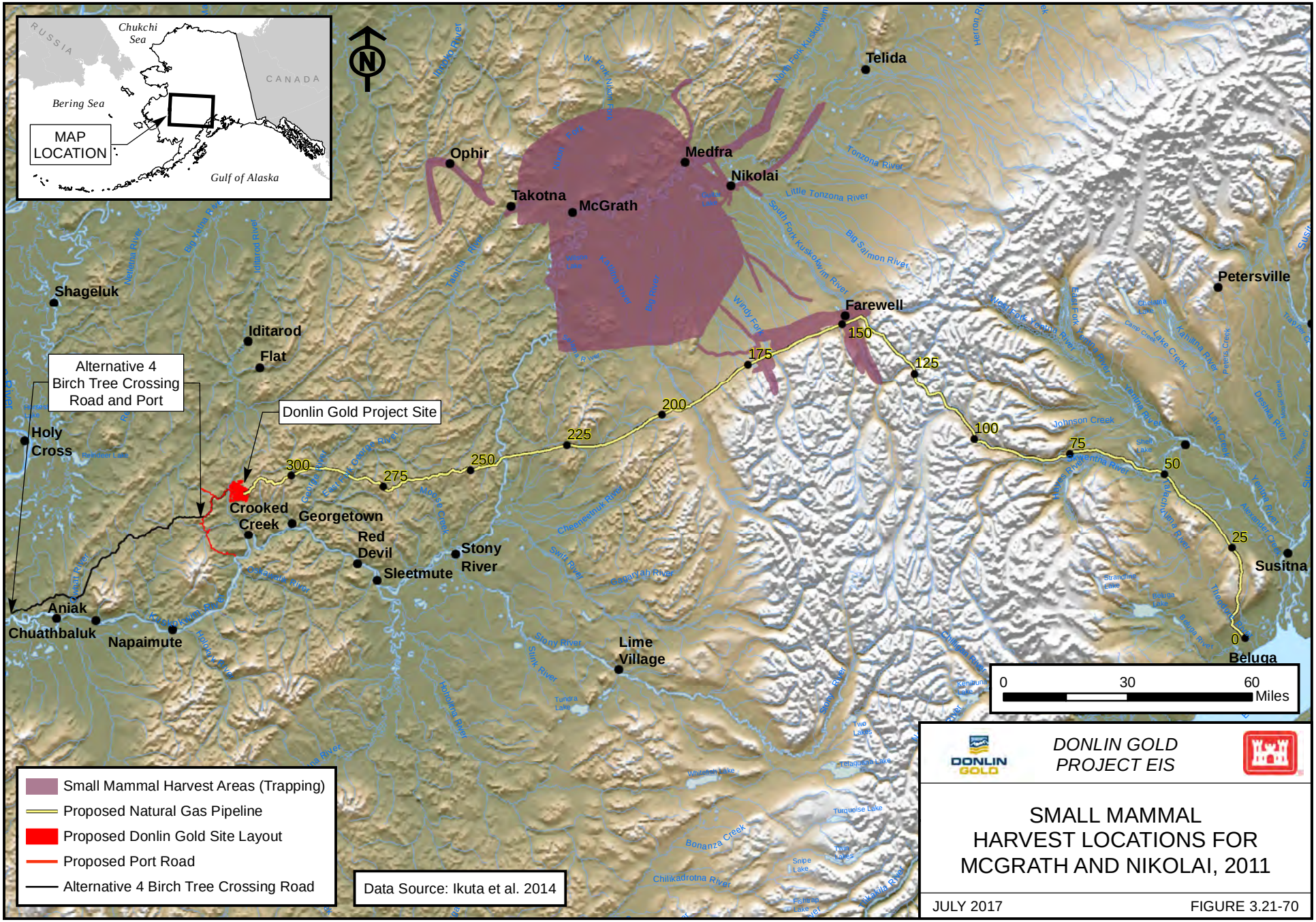
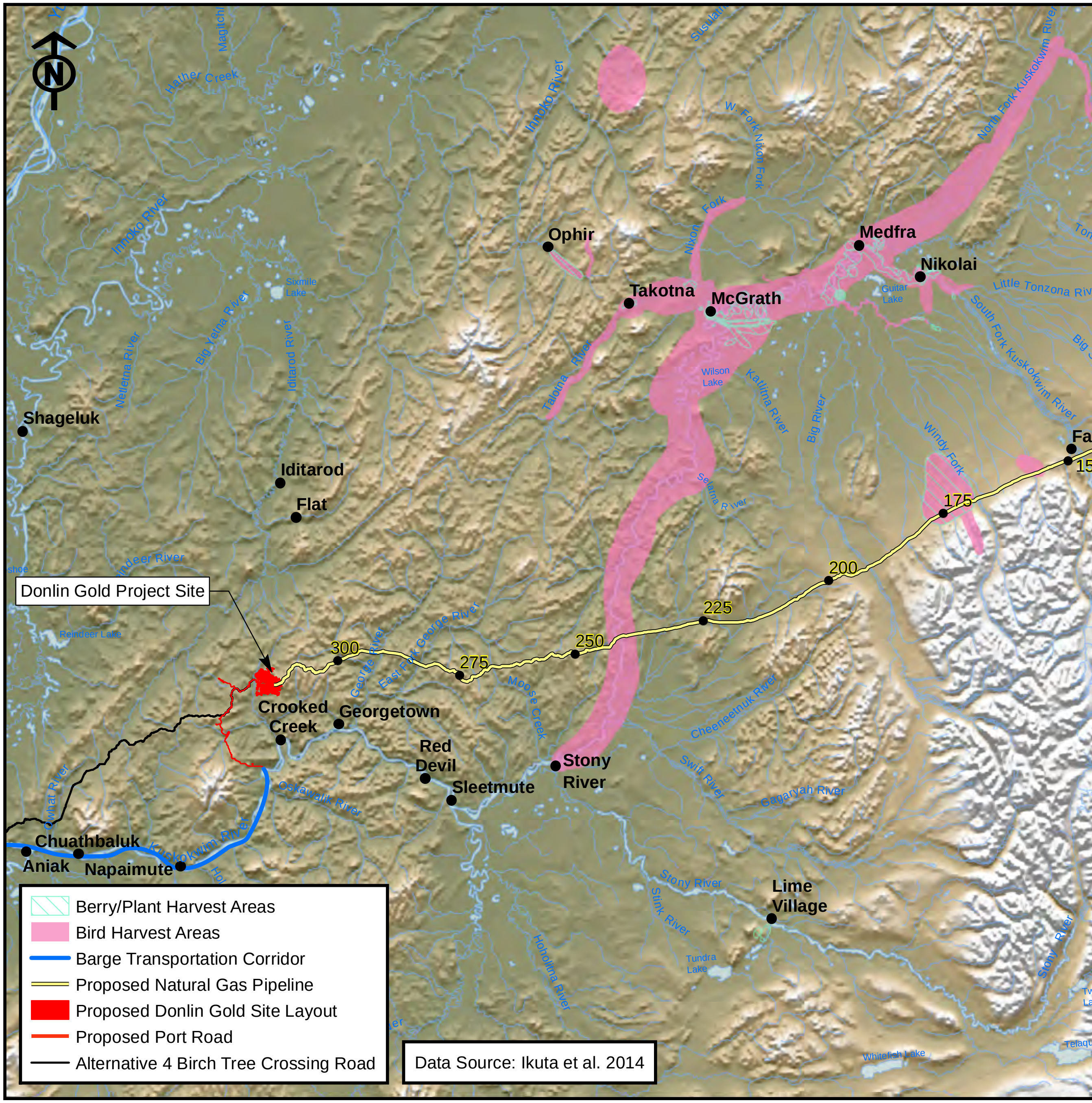
BLACK BEAR, BROWN BEAR, CARIBOU, AND MOOSE HARVEST LOCATIONS FOR MCGRATH AND NIKOLAI, 2011

JULY 2017

FIGURE 3.21-69


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
N
Telida
Ophir
Medfra
Nikolai
Takotna
McGrath
Shageluk
Iditarod
Flat
Farewell
Petersville
Alternative 4 Birch Tree Crossing Road and Port
Donlin Gold Project Site
Holy Cross
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Aniak
Chuathbaluk
Napaimute
Lime Village
Susitna
Beluga
150
175
125
200
100
225
75
250
50
275
25
300
0
0 30 60 Miles
Small Mammal Harvest Areas (Trapping)
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Data Source: Ikuta et al. 2014
DONLIN GOLD
DONLIN GOLD PROJECT EIS
SMALL MAMMAL HARVEST LOCATIONS FOR MCGRATH AND NIKOLAI, 2011
JULY 2017
FIGURE 3.21-70

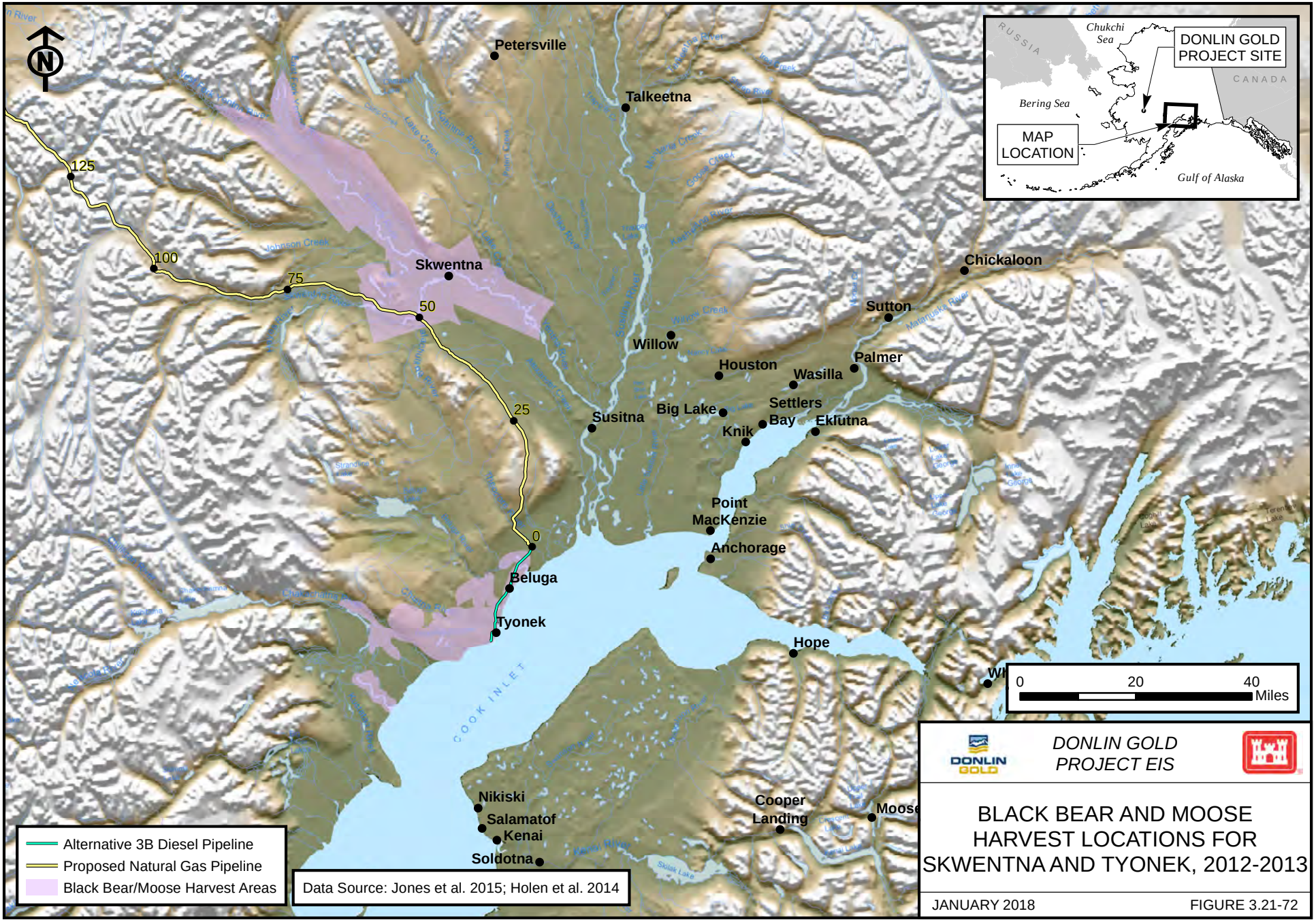


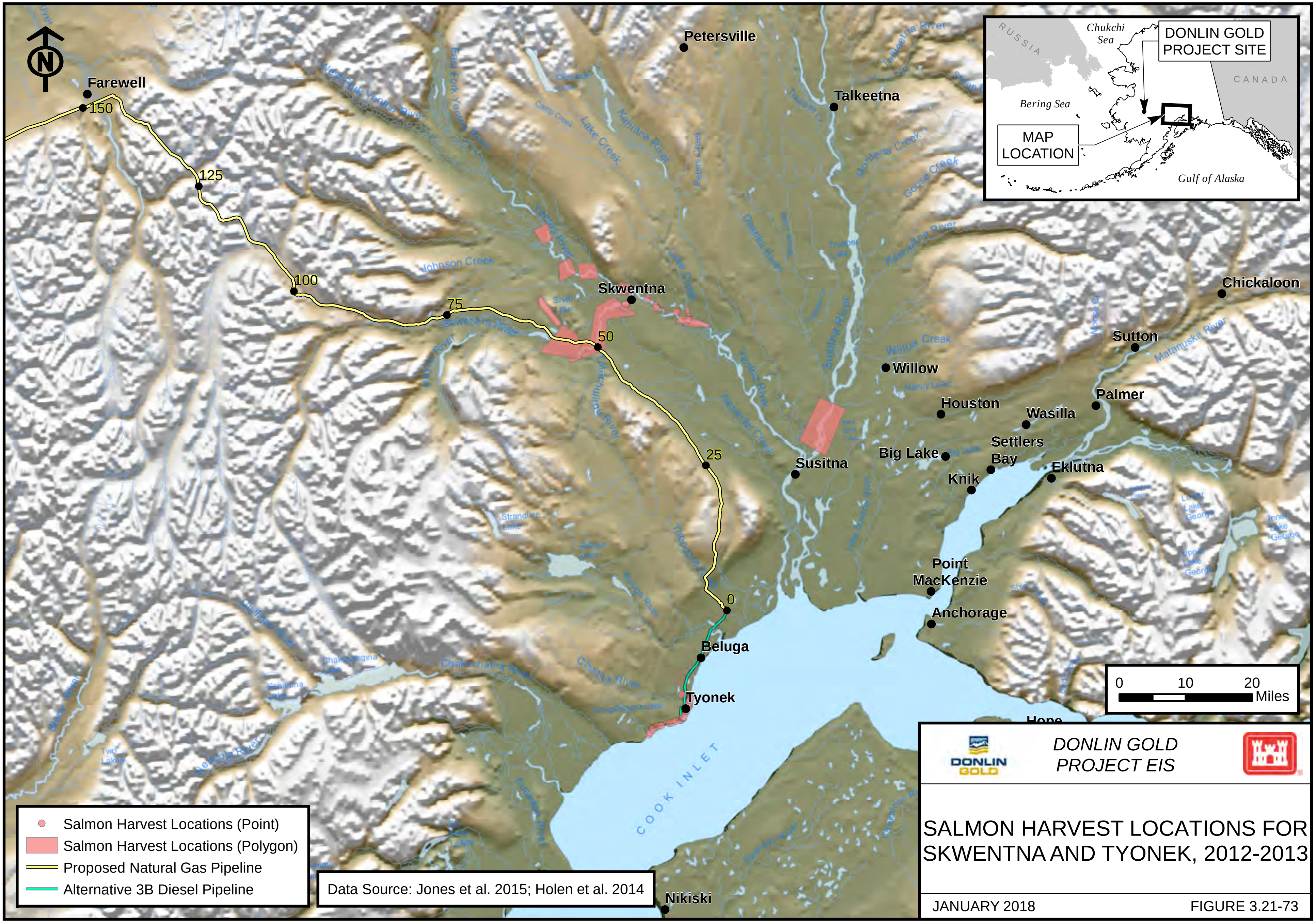
DONLIN GOLD PROJECT EIS

BERRY, PLANT, AND BIRD HARVEST LOCATIONS FOR MCGRATH AND NIKOLAI, 2011

JULY 2017

FIGURE 3.21-71


Petersville
Talkeetna
Skwentna
Willow
Houston
Wasilla
Palmer
Chickaloon
Sutton
Susitna
Big Lake
Settlers Bay
Eklutna
Knik
Point MacKenzie
Anchorage
Beluga
Tyonek
Hope
Nikiski
Salamatof
Kenai
Soldotna
Cooper Landing
Moose
125
100
75
50
25
0
COOK INLET
RUSSIA
Chukchi Sea
Bering Sea
CANADA
Gulf of Alaska
DONLIN GOLD PROJECT SITE
MAP LOCATION
0
20
40
Miles
Alternative 3B Diesel Pipeline
Proposed Natural Gas Pipeline
Black Bear/Moose Harvest Areas
Data Source: Jones et al. 2015; Holen et al. 2014
DONLIN GOLD PROJECT EIS
BLACK BEAR AND MOOSE HARVEST LOCATIONS FOR SKWENTNA AND TYONEK, 2012-2013
JANUARY 2018
FIGURE 3.21-72

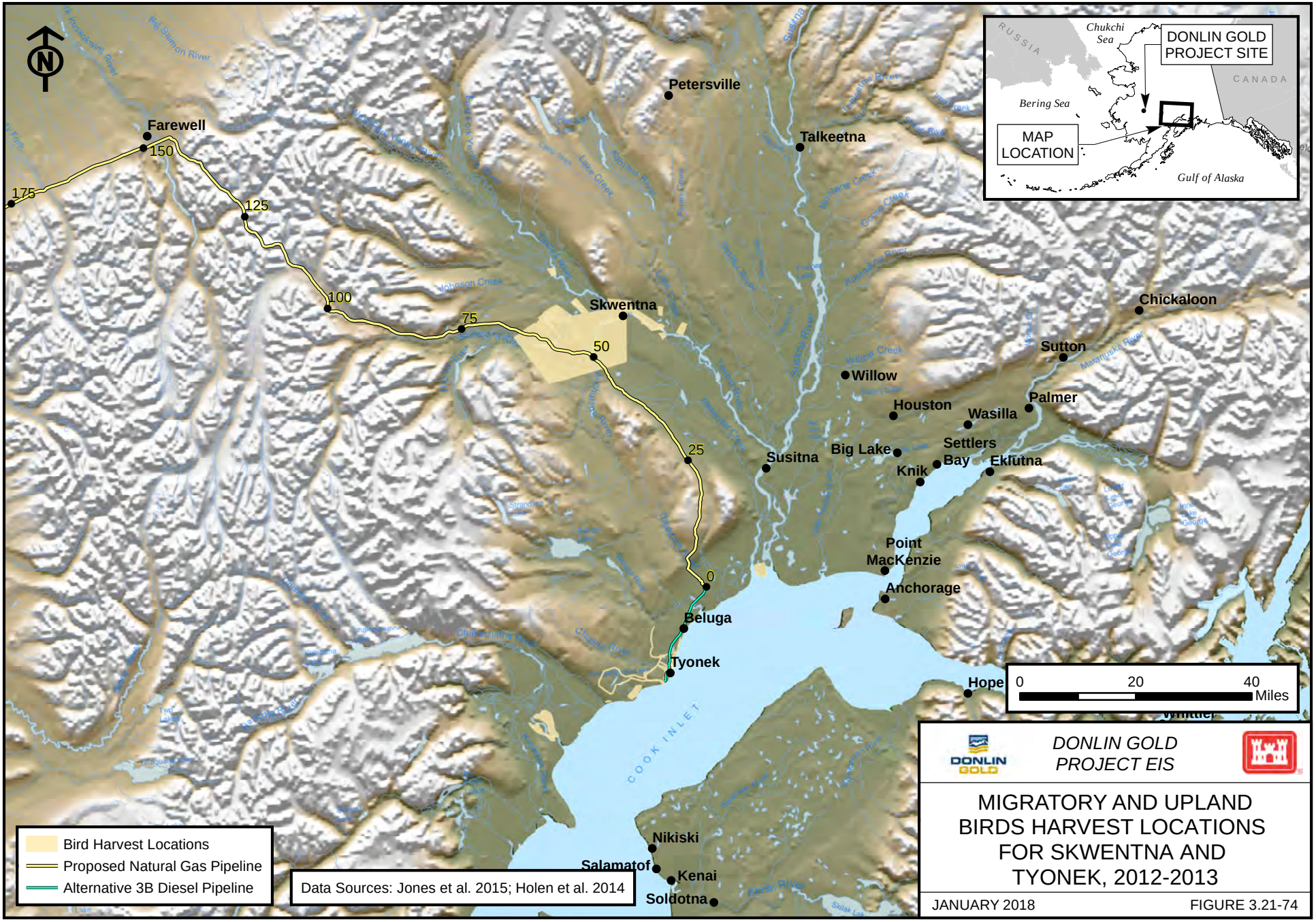


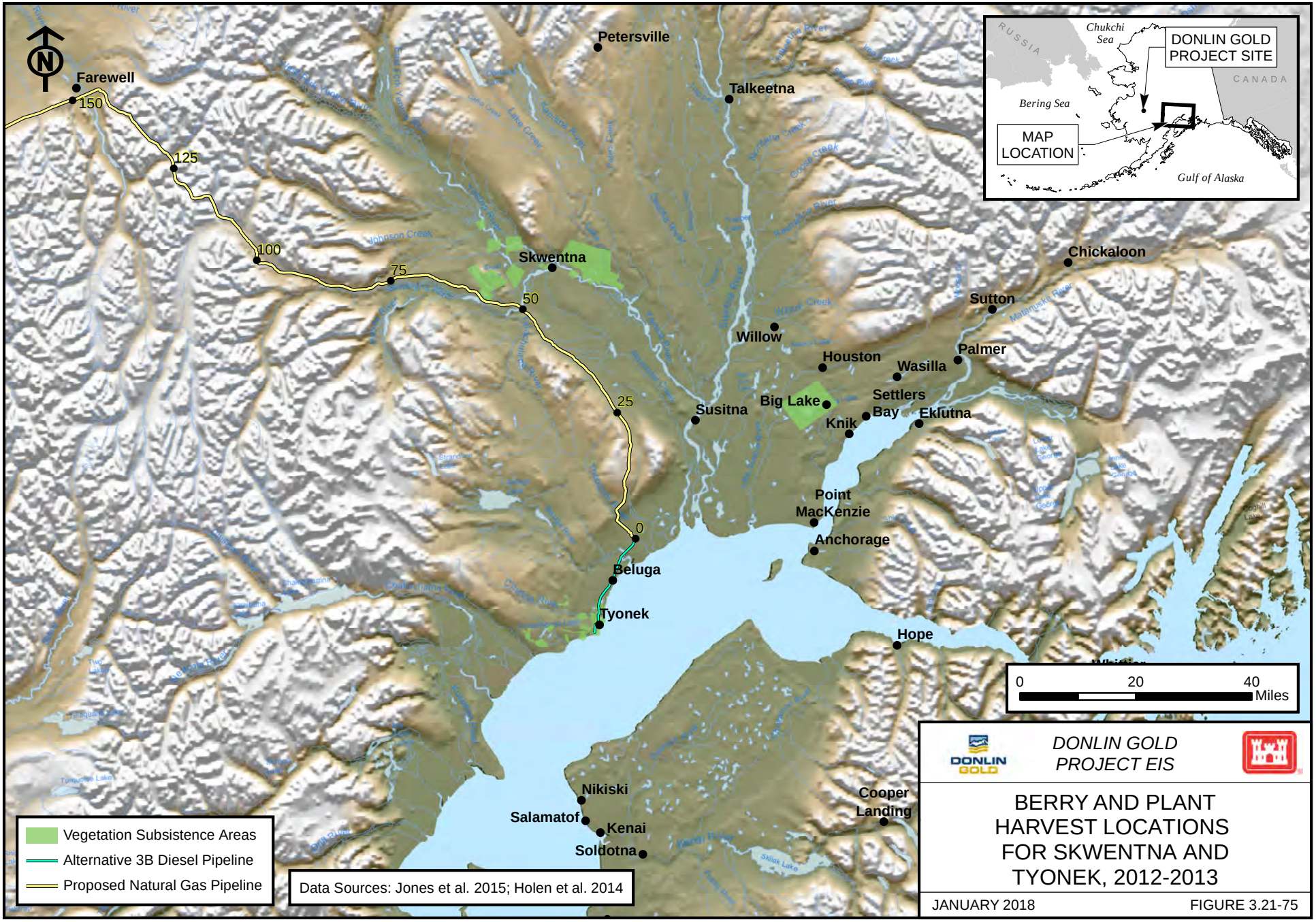
DONLIN GOLD PROJECT EIS

SALMON HARVEST LOCATIONS FOR SKWENTNA AND TYONEK, 2012-2013

JANUARY 2018

FIGURE 3.21-73


Farewell
150
175
125
100
75
50
25
0
Petersville
Talkeetna
Skwentna
Willow
Houston
Wasilla
Palmer
Sutton
Chickaloon
Susitna
Big Lake
Settlers Bay
Eklutna
Knik
Point MacKenzie
Anchorage
Beluga
Tyonek
Hope
Nikiski
Salamatof
Kenai
Soldotna
COOK INLET
Bird Harvest Locations
Proposed Natural Gas Pipeline
Alternative 3B Diesel Pipeline
Data Sources: Jones et al. 2015; Holen et al. 2014
0
20
40
Miles
RUSSIA
Chukchi Sea
Bering Sea
CANADA
Gulf of Alaska
DONLIN GOLD PROJECT SITE
MAP LOCATION
DONLIN GOLD
DONLIN GOLD PROJECT EIS
MIGRATORY AND UPLAND BIRDS HARVEST LOCATIONS FOR SKWENTNA AND TYONEK, 2012-2013
JANUARY 2018
FIGURE 3.21-74


Petersville
Talkeetna
Farewell
150
125
100
75
50
25
0
Skwentna
Willow
Houston
Wasilla
Palmer
Chickaloon
Sutton
Big Lake
Susitna
Settlers Bay
Knik
Eklutna
Point MacKenzie
Anchorage
Beluga
Tyonek
Hope
Nikiski
Salamatof
Kenai
Soldotna
Cooper Landing
RUSSIA
Chukchi Sea
Bering Sea
CANADA
Gulf of Alaska
DONLIN GOLD PROJECT SITE
MAP LOCATION
0
20
40
Miles
Vegetation Subsistence Areas
Alternative 3B Diesel Pipeline
Proposed Natural Gas Pipeline
Data Sources: Jones et al. 2015; Holen et al. 2014
DONLIN GOLD
DONLIN GOLD PROJECT EIS
BERRY AND PLANT HARVEST LOCATIONS FOR SKWENTNA AND TYONEK, 2012-2013
JANUARY 2018
FIGURE 3.21-75

The construction schedule shows the seasons of activity in the vicinity of subsistence use areas for the communities noted above. Section 6, which includes the subsistence use area of Crooked Creek, would be built during summer, while Section 5, which crosses the subsistence use area of Stony River, would be built during the winter. Section 4, which includes the harvest area of McGrath and Nikolai, would be built during the winter and completed by April, as would Sections 1 and 2 nearest Skwentna.

The ROW is narrow and relatively small compared to the subsistence areas of these communities, and because most of the construction in these sections would take place primarily during the winter, problems of access to subsistence resources would be reduced, compared to what would occur if construction were scheduled for other times of year.

If noise and the presence of humans during Construction divert animals from their normal habitat or make them more difficult to approach, hunting may become more difficult. The effect would likely be primarily during active Construction and limited only to particular sections of the Pipeline. Regarding the overlap of the Pipeline with the Skwentna village fishing area, the Skwentna River crossing would employ Horizontal Directional Drilling and is scheduled for a winter construction sequence, thereby minimizing impacts to fish and subsistence fishing during the open water season.

Portions of the Pipeline ROW may be temporarily closed to hunting and access while equipment and personnel are present for safety reasons. To minimize impacts to subsistence access, Donlin Gold intends to work with people either to allow controlled access through or within construction zones, or to provide alternate access.

Effects on Access to Subsistence Resources (Operations and Closure)

During Operations, the natural gas pipeline would be buried, with minimal aboveground infrastructure. Temporary ancillary facilities used in Pipeline construction (such as roads, airstrips, and material sites, would be stabilized, recontoured, reclaimed, and revegetated (Section 2.3.2.3.6). The Pipeline ROW would not be fenced, so there would be no obstruction to subsistence users traversing the ROW. There would be no permanent road alongside the Pipeline, but vegetation in the ROW would be cleared during Operations every 10 years to allow for maintenance and visual monitoring. The ROW brushing may provide for a more accessible and visible corridor, reducing vegetation obstruction for potential sport and subsistence hunting access and activities. The amount of additional access that could occur is a factor of the access currently available along the INHT, ability to access the Pipeline ROW from existing communities and airstrips such as Farewell, and adaptive management steps taken to discourage public access along the Pipeline ROW (see discussion below).

All aboveground infrastructure would be dismantled and removed during Closure. The effects of Operations and Closure would be much less than during the Construction Phase.

Effects on Competition for Subsistence Resources (Construction; Operations; and Closure)

The Pipeline Construction phase would not be expected to directly increase external competition for subsistence resources from project employees, as employees would be prohibited from sport hunting and fishing while on the job site. Construction workers would be prohibited from having firearms or hunting from their project workplaces. Their exposure to

potentially new hunting areas could indirectly lead to a small increase in hunting pressure following the Construction Phase. However, as an indirect effect, once Construction is completed, publically accessible construction-related transportation improvements at Farewell Airstrip and the cleared Pipeline corridor itself may increase out-of-region competition for subsistence resources.

This is a major concern of local residents who believe that infrastructure developed to support Pipeline Construction would offer enhanced opportunities for non-locals to access the area. Given the distance from population centers and access points, and the lack of surface transportation improvements, it is unlikely that OHV traffic from the west side of Cook Inlet would reach the subsistence use areas of communities of the EIS Analysis Area because of the Pipeline ROW. Winter access by snowmachine along the Pipeline ROW would be possible, but the likely increase in use is mitigated by the fact that it is currently possible via the INHT. Given the distances involved, the likely use by new recreational hunters entering the subsistence use areas west of the Alaska Range is very low. The temporary airstrips used during Construction would be decommissioned to avoid subsequent use.

Local residents cite various instances where non-locals currently use remote airstrips, such as Farewell Airstrip, to gain access to hunt. Non-local hunters also fly OHVs to this airstrip and trails extend out from the airstrip for many miles. The Pipeline ROW is adjacent to the airstrip and could further extend the reach of non-local hunters on OHVs. As expressed in EIS meetings, this is a concern of local people, particularly residents of Nikolai who have hunting camps in the vicinity of the Pipeline ROW (URS 2014e). According to Section 3.12, Wildlife:

> "Donlin Gold would attempt to limit public use of the six new airstrips during construction of the pipeline corridor, but some public use may occur. Current hunting access in many areas is primarily by small aircraft that land on gravel bars, tundra, or lakes. Some hunting parties currently land at the existing airstrip at Farewell with ORVs and hunt in the surrounding area. The availability of landing strips during construction at nine additional locations could allow the expansion of hunting pressure and other recreational uses in nearby areas that were previously difficult to access. After the Construction Phase, the six new airstrips would be made non-functional by excavating berms and/or trenches across the strip. This technique has been demonstrated to prevent continued use of temporary airstrips (Donlin Gold 2016c)."

For McGrath and Nikolai, the overlap of subsistence use areas and the Pipeline ROW was noted above. Additional information regarding the distribution of effort and hunting success for black bear, caribou, and moose within the subsistence use areas of McGrath and Nikolai is found in ADFG harvest tickets, as reported in Donlin Gold 2016f. These data indicate that effort and hunting success for these two communities taking of moose is heavily concentrated in Unit 19D along the upper Kuskokwim River and the North Fork and South Fork of the Kuskokwim River. Boats are the most common means of access. The distinction in harvest areas is particularly pronounced for moose. For the period 2010-2015, McGrath residents reported 4 hunts in Unit 19C and 759 hunts in unit 19D. Nikolai residents reported 10 hunts in Unit 19C and 274 hunts in Unit 19D. Thus, any new competition along the Pipeline ROW would affect a small portion of the subsistence use areas in question, and portions well to the south of the river corridors with greater concentration of effort. Considering use area maps, harvest ticket data, and resident testimony together, it is likely that any new competition associated with the Farewell Airstrip would have small effects on the subsistence users of McGrath and Nikolai.

Effects on Sociocultural Aspects of Subsistence (Construction; Operations; and Closure)

The sociocultural effects of Pipeline Construction would be similar to those associated with Project-related employment and income described under the Mine Site above, except that large scale employment is associated with the Construction phase (2.5 years) with minimal employment associated with the Pipeline during the Operational Phase.

3.21.6.3.4 CLIMATE CHANGE

The Donlin Gold Project would contribute to climate change as discussed in Section 3.8, Air Quality, through production of greenhouse gasses. The level of greenhouse gas emissions generated by implementation of Alternative 2 is not likely to create climate change effects to subsistence. However, if current climate change trends continue, then the impacts to key subsistence resources, such as salmon, moose, and waterfowl, will continue to be affected as described in Section 3.26, Climate Change.

3.21.6.3.5 SUMMARY OF IMPACTS - ALTERNATIVE 2

Mine Site - Construction and Operations. For the Mine Site, the following discussion takes into account impacts to subsistence due to changes in resources, changes in access, changes in competition, and changes in sociocultural practices.

The intensity of impacts to subsistence from noise disturbance and activities at the Mine Site would primarily affect the residents of Crooked Creek, who have historically relied in part upon resources from the Mine Site vicinity (and the mine access road and Angyaruaq [Jungjuk] Port site, discussed below in the Transportation Corridor). Aniak residents have a mapped area for berry picking north of the Mine Site and those residents may also be displaced from portions of that area due to fugitive dust. Disturbance and displacement of subsistence resources affect the Crooked Creek drainage, overlapping with bear hunting, fur trapping and waterfowl hunting areas for Crooked Creek residents and a berry picking area for Aniak residents. Other communities in the EIS Analysis Area do not have subsistence use areas overlapping or adjacent to the Mine Site.

Since the Crooked Creek drainage was not an area of concentrated subsistence hunting or trapping when compared to the entirety of the Crooked Creek and Aniak subsistence use areas, small adjustments in the seasonal round (i.e., redirection of harvest activity to other portion of the subsistence use area) would be needed to sustain harvest levels. Potential impacts to aquatic habitat and fish resources in the Crooked Creek drainage are likely primarily in the middle reaches of the drainage, from Anaconda Creek to Snow Gulch, alongside the Mine Site, while the lower portion of the drainage, below Crevice Creek, would likely see limited effects (Table 3.13-26). Subsistence fishing use area maps for Crooked Creek residents show salmon and non-salmon fishing extending only to Bell Creek within the lower reaches of the drainage (Figure 3.21-17, and Figure 5-12 in CL Brown et al. 2012). As a result, effects on salmon and non-salmon species subsistence fishing are unlikely.

As an indirect effect, Bering Sea Coast villages that rely on migratory waterfowl that could pass through the Mine Site may be concerned about the potential for contamination of waterfowl at the Mine Site and may avoid waterfowl harvests as a result. The Ecological Risk Assessment

indicated that the risk to wildlife and birds from chemical exposure in the pit is unlikely or low (see Section 3.12.2.5).

Increased competition due to employment at the mine site would be reduced by policies prohibiting employees from hunting and fishing while at the Mine Site and by the enclave development strategy with housing at the Mine Site and transportation provided for employees commuting between their communities and the Mine Site.

Sociocultural impacts associated with potential mine employment would be beneficial for most villages in the EIS Analysis Area, based on new income from project employment to invest in subsistence activities. As discussed in more detail in subsection Effects on Sociocultural Aspects of Subsistence above, project employment and incomes would affect 25 to 29 percent of area households during Construction and 5 to 9 percent of households during Operations. The benefits would be more concentrated in the Central Kuskokwim subregion due to higher relative levels of project employment in communities nearer the Mine Site. Outmigration and adverse effects of rotation work shifts may affect up to half of households with project employment (2.5 to 4.5 percent of area households), with potentially greater impacts in the smaller communities with more concentrated project employment. As high income is associated with higher subsistence production, and subsistence food are widely shared, the benefit would extend beyond employed households. The duration of most effects would be 31.5 years, associated with the Construction and Operations phases.

Mine Site – Closure. After Closure of the Mine Site under Alternative 2, active mining would cease and the mine site would be reclaimed, greatly reducing the effects on subsistence resources and their habitats. Without the disturbance of the mine operation, and with revegetation of the main features of the mine, wildlife such as black bears and furbearers are likely to reoccupy the Mine Site over time, and subsistence uses may be reestablished.

Project effects on competition and the socio-cultural effects of project related employment and income would largely cease. The sociocultural impacts to subsistence during Closure would include the loss of income to invest in subsistence practices, perhaps partially offset by other economic growth activities and planning for economic diversification at Closure.

As an indirect effect, some Bering Sea Coast subsistence users may continue to have concerns about waterfowl becoming contaminated during their migration through the Mine Site area. The pit lake would fill over an estimated 50 years, though wildlife species and birds are expected to be at low risk of contamination from ingestion of surface water from the pit lake. For fuller discussion of the Ecological Risk Assessment concerning the pit lake, see Section 3.12.2.5.1.

The geographic extent of many impacts would be localized to the vicinity of the Mine Site. Impacts due to changes in resources and access are associated with the near vicinity of the Mine Site, except that concerns about impacts of contamination of waterfowl would extend out to the Bering Sea Coast, along the birds' migratory path. Impacts to subsistence associated with mine employment income and related changes in local competition and sociocultural practices would be widespread, since the priority on hiring shareholders extends throughout the Yukon Kuskokwim Delta.

The context of affected subsistence resources and practices includes migratory waterfowl protected by statute. Sociocultural impacts would affect subsistence practices that are central to

the economies, social organizations, and cultural identities of communities throughout the EIS Analysis Area.

Transportation Corridor – Construction and Operations. The intensity of impacts would vary, taking into account the habitat loss; disturbance and displacement of access to subsistence fish, marine mammals, terrestrial mammals, birds, and plants; and fugitive dust from vehicle traffic. The disturbance to subsistence fish and fishing would be greater in the narrow and shallow reaches of the Kuskokwim River near Birch Tree Crossing, Aniak, and the Upper Oskawalik River. Impacts on access would affect small portions of the Crooked Creek subsistence use area along the road and the port site. Other Central Kuskokwim River communities also use the river corridor for hunting and berry picking and would be affected in a small portion of their use areas by the mine access road and port site. For terrestrial species, changes in resource abundance and access would necessitate small adjustments in harvest patterns and alternative areas and harvest opportunities are generally readily available at small increases in cost and effort. Noise disturbance from river barge traffic may affect moose availability along the riverbanks, though subsistence users disagree on the extent to which this would occur. Small reductions in overall harvest are expected. Ocean barge disturbance to marine mammals in the Kuskokwim River below Bethel is less extensive than river barge traffic due to the smaller number of ocean barge trips and the wider configuration of the river.

In regard to Kuskokwim River subsistence fishing, river barge passage at intervals of approximately 8 hours would result in chronic and intermittent disturbance to subsistence fishing along the river barging corridor, particularly in the shallow and narrow reaches. This may result in displacement of drift net subsistence fishers, or small intensity impairment of access for shore-based subsistence activities (set nets and processing rafts). Although the increase in barging activity and intervals between barge tow passages can be quantified, it is not possible to quantify a likely percent of decline in subsistence fishing harvest levels as a result. Subsistence harvest practices are strategic and adaptive. Subsistence users have harvest targets and may redirect effort to adjacent areas, extend time spent in harvesting, or increase harvest of other species to compensate for impaired access in some areas. As a result, it is not possible to extrapolate a linear relation between increased disturbance and reduced overall harvest success. As noted above, taking fishing areas, narrow reaches of the river, and intermittent barge disturbance together, it is likely that for some fishing families the effects will be of greater intensity, requiring changes in scheduling of fishing activities or relocation of fishing areas. Salmon runs return along the Kuskokwim River from the mouth to the spawning streams, so alternative fishing locations are available. The necessity of rescheduling around barge tow transits or relocating to alternative fishing locations would likely impose moderate costs and effort.

Impacts from external and in-region competition would be the same as for the Mine Site. Impacts to sociocultural aspects of subsistence would be the same as the Mine Site, though employment in barging would be much smaller in number, seasonal, not year-round. The geographic extent of these impacts would extend throughout the communities in the Kuskokwim River below the Angyaruaq (Jungjuk) Port. The duration of these effects would continue for the Construction and Operations phases, or 31.5 years, and would be seasonally limited to the open-water transportation period. The context of affected resources includes Chinook salmon and moose that have been the focus of urgent conservation measures in the past few years.

Transportation Corridor – Closure. Effects during Closure would be greatly reduced compared to the Operations Phase. The reduced level of barging on the Kuskokwim River would reduce behavioral disturbance of fish and terrestrial mammals in the barging corridor. The effects would not be eliminated since the mine access road would remain operational and the types of effects associated with the road would continue, but at much lower levels. These effects would last indefinitely over the course of monitoring activities.

Pipeline - Construction. Habitat loss would occur in the 316-mile Pipeline construction ROW (11,500 acres) and the facilities supporting construction, such as borrow pits, staging areas, camps, and shoofly roads (2,600 acres). Disturbance and displacement of subsistence resources and subsistence uses from construction activities would occur for 2.5 years. The subsistence hunters of Tyonek, Skwentna, McGrath, Nikolai, Stony River, and Crooked Creek would likely experience effects on subsistence resources and access during the Construction Phase in the limited portions of their subsistence use areas that overlap with the pipeline corridor. Redirection of harvest patterns to other parts of the traditional use area, at relatively low cost and effort, would likely maintain harvest levels. During Construction, the effects would be concentrated in a limited area near active construction in the ROW, and would affect the period of construction activities plus a period of recovery for habitat and resources. The geographic extent of impacts would be localized to active construction areas, but arrayed along a long and narrow Pipeline ROW.

Pipeline – Operations and Closure. After Construction, the pipeline would be buried, with limited above ground facilities (fault crossings, block valves, and a pigging station). The ROW would not be fenced, but vegetation in the ROW would be cleared every 10 years to allow for maintenance and visual monitoring. The Pipeline construction infrastructure such as remote airstrips and access roads, would be stabilized, recontoured, and reclaimed following Construction, reducing the potential for increased access to subsistence resources by non-local residents and competition within the subsistence areas adjacent to the ROW. However, greater exposure to the region by non-residents and increased access for fly-in hunters and trappers at Farewell Airstrip and along the cleared ROW north and west of the Alaska Range could result in a small increase in competition, affecting the residents of McGrath and Nikolai, since their subsistence use areas for large land mammals, small land mammals, vegetation, and birds overlap with the Pipeline ROW. Specifically, these villages' subsistence use areas include the vicinity of the Farewell Airstrip and the Pipeline ROW to the west. Impacts during Operations and Closure would be of lower intensity, since the Pipeline is underground with limited exceptions. These effects would last through the life of the project, and localized to the ROW. The context of resources affected by the Pipeline under routine operations does not include migratory birds, Chinook salmon, or moose which are species protected by statute or subject to urgent conservation measures. Potential effects on salmon, including Chinook salmon, under a spill scenario, are analyzed in Section 3.24 Spill Risk. Subsistence practices are central to the economies, social organizations, and cultural identities of communities throughout the EIS Analysis Area.

Table 3.21-27: Summary of Impacts of Alternative 2 by Project Component

Impacts	Impact Level[1]			
	Magnitude or Intensity	Duration	Extent or Scope	Context
Mine Site				
Effects due to Changes in Resource Abundance and Availability	During Construction and Operations, localized habitat loss and noise disturbance may displace subsistence resources in the Crooked Creek drainage, including black bears, furbearers, waterfowl, and berries. Effects to subsistence fish in the Crooked Creek drainage would be limited. The affected areas are small portions of wildlife resource ranges. After Closure, most facilities would be recontoured and revegetated. Resources would reoccupy the Mine Site over time. The pit lake, mine access road, and a smaller port are exceptions that would last indefinitely. These have a smaller footprint and much reduced disturbance effects compared to the Constructions and Operations periods.	Most effects occur for the period of Constructions and Operations (31.5 years). Effects noted for the Closure period would occur indefinitely.	The direct effects for all phases are localized to the vicinity of the Mine Site, including the Crooked Creek drainage.	The subsistence resources affected at the mine site include common and relatively abundant species.
Effects Due to Changes in Access	During Construction and Operations, Crooked Creek residents would experience limitations on access and displacement of subsistence harvest areas for black bear, furbearers and waterfowl, primarily due to noise disturbance in the Crooked Creek drainage. Berry picking by Aniak residents, in an area located north of the mine site, may also be displaced due to fugitive dust. For both communities these are not concentrated areas of harvest and represent small portions of the subsistence harvest areas for Crooked Creek and Aniak. Access to alternative areas is readily available at small cost and effort. No other Kuskokwim River communities have subsistence use areas in the	Same as above	Direct effects are the same as above. Indirect effects of fear of contamination of waterfowl extend to the Bering Sea coast	The affected subsistence harvest practices are recognized in the federal rural subsistence priority under Title VIII of ANILCA. The context for migratory waterfowl includes protection under the Migratory Bird Treaty Act (which allows qualified subsistence users to harvest migratory birds).

Table 3.21-27: Summary of Impacts of Alternative 2 by Project Component

Impacts	Impact Level[1]			
	Magnitude or Intensity	Duration	Extent or Scope	Context
	vicinity of the Mine Site. As an indirect effect, Bering Sea Coast villages' use of waterfowl may be displaced by the perception of contamination from the Tailings Storage Facility, even though the biological analysis suggests very low risk. After Closure, disturbance effects cease, with minor exceptions associated with the continuing monitoring and the operation of a water treatment plant at the pit lake. Subsistence uses may be reestablished in the reclaimed areas over time. Concerns about contamination of waterfowl from the pit lake may continue indefinitely.			
Effects Due to Changes in Competition	Employment at the Mine Site would have very little direct effect on competition, since employees are prohibited from hunting and fishing while working. In addition, since commuting to the remote work place is at no cost, very few employees from outside the EIS Analysis Area are expected to relocate to villages near the project. Increased employment and incomes may indirectly contribute to competition among residents in the Kuskokwim River drainage for scarce resources such as Chinook salmon and moose. Effects would be greatly diminished after Closure.	Same as above	Effects realized by communities throughout the Kuskokwim River drainage.	The affected resources and uses include species that have been the focus of urgent conservation measures, namely Chinook Salmon and moose.

Table 3.21-27: Summary of Impacts of Alternative 2 by Project Component

Impacts	Impact Level[1]			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Sociocultural Effects on Subsistence	Increased incomes will benefit subsistence activities by defraying equipment and operating costs. With shareholder hire policies during Construction, beneficial effects of employment and income would reach an estimated 25-29 percent of households in the EIS Analysis Area. During Operations, from 5-9 percent of area households would see these benefits. For both phases, the percentage of households affected may be higher for communities located closer to the Mine Site. Project employment may also result in out-migration of about half of employed households, with effects on community subsistence production and sharing. Rotating work shifts may provide adequate flexibility to support subsistence activities, though about half of employee households may also find this adversely affects subsistence activities. After Closure – three decades of employment and incomes would cease. Incomes to invest in subsistence activities would end, as would adverse effects of employment on out-migration and rotating shiftwork.	Same as above	Effects occur in communities through the EIS Analysis Area.	Rural subsistence practices on federally managed lands and waters are recognized and protected in law (Title VIII of ANILCA). In addition, these culturally distinct, subsistence-based social groups are very rare in the US.
Transportation Corridor				
Effects due to Changes in Resource Abundance and Availability	During Construction and Operations, subsistence resources would be affected by habitat loss in small acreages associated with the port sites, airstrip and mine access road. Limited disturbance from river and ocean barge traffic would affect fish, birds, marine mammals, and terrestrial mammals, with greater	Most effects occur for the period of Constructions and Operations (31.5 years).	Effects realized by communities throughout the Kuskokwim River drainage.	The affected resources include species that have been the focus of urgent conservation measures, namely Chinook Salmon and moose.

Table 3.21-27: Summary of Impacts of Alternative 2 by Project Component

Impacts	Impact Level[1]			
	Magnitude or Intensity	Duration	Extent or Scope	Context
	effects in the narrow and shallow segments of the river, such as near Aniak and the Oskawalik River. Fugitive dust from vehicle traffic would affect berry resources along the mine access road. Changes in abundance would be likely to result in small decreases in harvest levels. The Closure Phase would result in reduced disturbance to subsistence resources.			
Effects Due to Changes in Access	During Construction and Operations, subsistence activities near the mine access road and Angyaruaq/Jungjuk port site would be displaced, affecting residents of Crooked Creek and other Kuskokwim River villages. River barge traffic would chronically and intermittently disturb subsistence fishing and moose hunting along the bank, with greater displacement in narrow and shallow segments of the Kuskokwim River near Birch Tree Crossing, Aniak, and Oskawalik River. Redirection to alternative times and places at moderate expense and effort would result in small decreases in harvest levels. The Closure Phase would result in reduced disturbance to subsistence access, and the mine access road may facilitate access to some areas.	Most effects occur for the period of Constructions and Operations (31.5 years). However, the mine access road would remain in place after Closure.	Same as above	The affected subsistence harvest practices are recognized in federal rural subsistence priority under Title VIII of ANILCA. Fish camps near Angyaruaq/Jungjuk port site are more unique in that it may be more difficult to relocate to alternative sites.
Effects due to Changes in Competition	Same as Mine Site	Same as Mine Site	Same as Mine Site	Same as Mine Site
Sociocultural Impacts	Same as Mine Site	Same as Mine Site	Same as Mine Site	Same as Mine Site
Pipeline				
Effects due to Changes in	During the 2.5 years of Construction, 14,100 acres of habitat would be affected	Construction Phase effects would occur	Effects would occur along the Pipeline	The affected resources are common and

Table 3.21-27: Summary of Impacts of Alternative 2 by Project Component

Impacts	Impact Level[1]			
	Magnitude or Intensity	Duration	Extent or Scope	Context
Subsistence Resources	along the 316-mile pipeline corridor. Construction activities and noise would affect subsistence resources beyond the pipeline corridor, but would be unlikely to result in reduced abundance. During Operations, the pipeline would be buried, with limited above ground facilities, and temporary construction facilities would be stabilized, recontoured and reclaimed. The ROW would not be fenced, but vegetation in the ROW would be cleared every 10 years to allow for maintenance and visual monitoring. Little effect on resource abundance is expected. After Closure, the brushing of the corridor would cease.	for 2.5 years. Operations effects would occur for 27 years, and Closure Phase effects would last indefinitely.	corridor.	widely available.
Effects Due to Changes in Access	The Pipeline corridor overlaps with portions of the subsistence use areas of Crooked Creek, Stony River, McGrath, Nikolai, Skwentna, and Tyonek. Displacement would be greater during Construction and very limited during Operations and Closure. The ROW affects small portions of these subsistence use area, and alternative areas would be available at low cost and effect, resulting in little change to harvest levels.	Same as above	Same as above	The affected subsistence harvest practices are recognized in the federal rural subsistence priority under Title VIII of ANILCA.
Effects due to Changes in Competition	Same as Mine Site, except that increased access for fly-in hunters and trappers at Farewell Airstrip and the Pipeline ROW to the north and west may lead to a small increase in competition for McGrath and Nikolai subsistence users.	Changes in competition would persist beyond the life of the project.	Same as Mine Site	Same as Mine Site
Sociocultural Impacts	Same as Mine Site	Same as Mine Site	Same as Mine Site	Same as Mine Site

Notes:
1 The impact level assessment accounts for impact reducing design features proposed by Donlin Gold and Standard Permit Conditions and BMPs that would be required. It does not account for additional mitigation measures being considered.

3.21.6.3.6 MITIGATION AND MONITORING FOR ALTERNATIVE 2

Effects determinations take into account impact reducing design features (Table 5.2-1 in Chapter 5, Impact Avoidance, Minimization, and Mitigation) proposed by Donlin Gold and also the Standard Permit Conditions and BMPs (Section 5.3) that would be implemented.

Design features important for reducing impacts to subsistence include:

- Where practicable, construction and maintenance schedules would seek to minimize impacts on subsistence hunting and fishing, with the understanding that some construction activities must also take advantage of seasonal and environmental conditions;
- Donlin Gold would implement a no hunting/fishing policy for employees at work sites to minimize competition from employees for local resources;
- The project design includes the development and implementation of a Construction Communications Plan to inform the public and commercial operators of construction activities;
- The project design includes shift work schedules to maximize opportunities for employees to remain active in subsistence harvest efforts during Construction and Operations phases;
- Donlin Gold's surface use agreements with Calista and The Kuskokwim Corporation (TKC) include the Donlin Advisory and Technical Review Oversight Committee (DATROC), which is active and meets quarterly. Appropriate project communications would be managed under the purview of the DATROC, ultimately in the form of advisory subcommittees. Donlin Gold has committed to two subcommittees, the Barge Subcommittee and Subsistence Subcommittee, which would act in parallel to engage and inform local communities. The primary function of these committees is to engage the local communities to identify locations and times when subsistence activities occur, and opportunities to avoid, eliminate, or reduce conflicts that serve to restrict access to subsistence resources during construction, operations and post-closure. The Subsistence Subcommittee would also contribute to the identification of practical and effective monitoring measures to address concerns of subsistence users that subsistence resources may be adversely affected by project-related activities and would support development of an information-sharing framework to efficiently and effectively share results of monitoring (and other project-related technical information), at a practical level, with local subsistence users;
- Development of a Mine Site wildlife protection plan (which may include elements typical to such plans as Avian Protection Plans) as a design feature to identify measures to prevent birds or wildlife from accessing the TSF, the pit lake, or other mine waters;
- Ocean and river fuel barges would be double hulled and have multiple isolated compartments for transporting fuel to reduce the risk of a spill;
- The project design includes a communication program, managed under purview of the DATROC Barge Subcommittee (see Design Feature A31), to keep local communities informed of the schedules and current status of barge traffic as well as minimize displacement of subsistence fishing by barges (see Appendix W for Donlin Gold's Barge

Communication Plan). Donlin Gold would consult with people experienced with navigation on Kuskokwim River to incorporate local knowledge as they are designing their barging operations and guidelines;

- River pilots would be used for all tug and barge traffic between the mouth of the Kuskokwim River and Bethel (see Appendix W for Donlin Gold's Barge Communication Plan);
- Donlin Gold would develop and implement a rainbow smelt monitoring program to establish additional baseline data for a better understanding of the species' occurrence and the character, use, and distribution of spawning habitat along the Kuskokwim River. Survey methodology would likely include documenting sex ratio and age structure of the population and if possible, fecundity of females. Initially, surveys would be conducted annually to document the age structure of the rainbow smelt population and further document spawning patterns. Once an adequate baseline is established, regular sampling would be used to monitor for changes to existing patterns. The frequency of surveys over the long-term would depend on previous results and whether the data indicate a potential shift;
- If rainbow smelt population changes are observed over a defined time period, additional work would need to be undertaken to investigate the reason for those changes. If observed changes were attributed to project-related activities, Donlin Gold would implement an assessment of measures available to address or mitigate those activities. Such activities would be coordinated with the DATROC Subsistence Subcommittee. (Donlin Gold 2018a);
- The project design includes a natural gas pipeline to decrease amount of barging to transport diesel fuel. The design decision to use a natural gas pipeline instead of barging 110 Mgal of diesel per year was in response to community concern about barge traffic levels;
- Appropriate notices, warning signs, and flagging would be used to promote public safety. Barricades may also be used around dangerous areas such as open trenches during construction;
- The project design includes routing of the pipeline and siting of the related compressor station along an existing corridor in Susitna Flats State Game Refuge to minimize impacts; and
- Donlin Gold would coordinate with and help educate people who want to travel in the area during the pipeline construction period through its Public Outreach Plan to either allow controlled access through or within construction zones or identify alternate access.

Standard Permit Conditions and BMPs important for reducing impacts to subsistence include:

- Implementation of Stormwater Pollution Prevention Plans (SWPPPs) and/or Erosion and Sediment Control Plans (ESCPs) and use of industry standard BMPs for sediment and erosion control;
- Compliance with permit provisions established by the State of Alaska to ensure the proper protection of aquatic resources in Crooked Creek pursuant to the Appropriation

and Use of Water (11 AAC 90.035-147), Anadromous Fish Act (AS 16.05.871-901), and Fish Passage Act (AS 16.05.841);

- Development and maintenance of Oil Discharge Prevention and Contingency Plans (ODPCPs), Spill Prevention, Control, and Countermeasure (SPCC) Plans, and Facility Response (FRP) Plans;
- Use of BMPs such as revegetation planning, watering and use of dust suppressants to control fugitive dust and avoid impacts on subsistence berry picking activities.

Additional measures are being considered by the Corps and Cooperating agencies to further minimize project impacts, as reasonable and practicable, and are further assessed in Chapter 5, Impact Avoidance, Minimization, and Mitigation (Section 5.5 and Section 5.7). Examples of additional measures being considered that are applicable to this resource include:

- Install signs that clearly distinguish trails from the pipeline ROW at points where the pipeline crosses trails to guide trail users to stay on the trail and off of the pipeline ROW where the two are not collocated. As practicable, revegetate, or otherwise block access to, a narrow strip of the pipeline ROW where it crosses the trail to help steer and keep trail users on the trail and reduce the visual effect of the pipeline ROW crossing;
- Where appropriate, employ seasonal timing restrictions on blasting, as stipulated by resource agencies, to reduce noise related effects of blasting during sensitive subsistence hunting activities (e.g., fall moose hunting); and
- Develop a Subsistence Plan and Report which would incorporate BMPs for the mine operations to maintain or improve subsistence activities and avoid potential conflicts. The plan may be developed with input from the local subsistence users, and may be organized through efforts from DATROC; and
- Include speed limits in barge guidelines proposed as a design feature and identify periods of limited or suspended barging, to the extent practicable. Limit barging or restricted timing of barges during key commercial or subsistence fishing periods. Suspend barging during the smelt spawn (May) until the spawn is over.

3.21.6.4 ALTERNATIVE 3A – REDUCED DIESEL BARGING: LNG-POWERED HAUL TRUCKS

Under Alternative 3A, LNG-powered haul trucks would replace diesel powered haul trucks, thereby reducing diesel fuel transportation and use at the Mine Site. Project barge traffic of 83 round trips per years would be in addition to the existing baseline estimate of 68 barge trips. Total project-related river barge traffic, including fuel and supply barges, would be reduced from an estimated 122 annual barge tow round trips in Alternative 2 to 83 round trips in Alternative 3A (Table 3.21-28).

Table 3.21-28: Annual River Barge Traffic During Operations: Alternatives 2 and 3A

	Number of Round Trips Per Season	
	Alternative 2	**Alternative 3A**
Estimated Baseline[1]	68	68
Project-related Cargo[2]	64	64
Project-related Fuel[3]	58	19
Total Project-related	**122**	**83**

Notes:
1 Current barge traffic typically consists of one or two 40-ft by 160-ft barges with a pusher tug.
2 Cargo tows would be composed of a tug pushing four barges. Each cargo barge would be 44 ft wide and 150 ft long.
3 Fuel tows would be composed of a tug pushing four double-hulled barges. Each fuel barge would be 44 ft wide and 165 ft long.
Project-related quantities represent peak years

Source: SRK 2013a; Krall 2013

3.21.6.4.1 TRANSPORTATION CORRIDOR

Compared with Alternative 2, this smaller number of river barge tows would reduce the disturbance to subsistence resources (riverine habitat and subsistence fish and wildlife resources), and potential barge interference with subsistence access (subsistence fishing gear, fish camps, and processing rafts). The reduction in barge tow frequency would reduce the intensity of effects since it would translate into larger time intervals between barges. Under Alternative 2, it was estimated that 2-3 barge passings would occur per day, or at an interval of about 8 to 12 hours between passings. Under Alternative 3, total annual project-related barge tow round trips would be reduced to 83, representing 166 one-way barge tow trips. In the 110-day barging season, this would result in 1-2 barge passings per day, with an interval of roughly 12-24 hours between barge passings. The reduction in barge tow disturbance would reduce the need for subsistence fishers in affected reaches of the river to redirect their effort to alternative locations, resulting in a lower intensity of impacts on subsistence fishing.

Competition for resources and sociocultural impacts to subsistence practices would be the same as Alternative 2. Sociocultural effects from employment and income from barge traffic may be slightly reduced.

3.21.6.4.2 MINE SITE AND PIPELINE

Direct and indirect effects on subsistence uses from changes in subsistence resources and access to subsistence resources in the vicinity of the Mine Site and along the Pipeline would be the same as in Alternative 2, since there would be no change in these project component footprints and activities under Alternative 3A.

3.21.6.4.3 SUMMARY OF IMPACTS - ALTERNATIVE 3A

As with Alternative 2, the duration of effects would be the life of the project and would extend along the Kuskokwim River barging corridor. The context of the affected resources would include effects on Chinook salmon and moose, resources for which urgent conservation measure have been adopted in recent years. Impacts associated with climate change would also

be the same as discussed for Alternative 2. The effects determinations take into account applicable impact reducing design features, and BMPs and standard permit conditions as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

3.21.6.5 ALTERNATIVE 3B – REDUCED DIESEL BARGING: DIESEL PIPELINE

Under Alternative 3B, an 18-inch diameter buried diesel pipeline would be constructed instead of transporting diesel fuel by barge on the Kuskokwim River. The diesel pipeline would be installed in the same ROW as the natural gas pipeline under Alternative 2, except that an additional 18-mile segment would be needed to reach a diesel fuel dock at the Tyonek North Foreland Facility. The existing fuel dock would be modified to receive an estimated 12 tankers per year, delivering the annual supply of 120 Mgal of diesel to be transported through the Pipeline to the Donlin Gold Mine Site (Section 2.3.4, Chapter 2, Alternatives).

Two options to Alternative 3B have been added based on Draft EIS comments from agencies and the public:

- Port MacKenzie Option: The Port MacKenzie Option would utilize the existing Port MacKenzie facility to receive and unload diesel tankers instead of the Tyonek facility considered under Alternative 3B. A pumping station and tank farm of similar size to the Tyonek conceptual design would be provided at Port MacKenzie. A pipeline would extend northwest from Port MacKenzie, route around the Susitna Flats State Game Refuge, cross the Little Susitna and Susitna rivers, and connect with the Alternative 3B alignment at approximately MP 28. In this option, there would be no improvements to the existing Tyonek dock; a pumping station and tank farm would not be constructed near Tyonek; and the pipeline from the Tyonek tank farm considered under Alternative 3B to MP 28 would not be constructed.
- Collocated Natural Gas and Diesel Pipeline Option: The Collocated Natural Gas and Diesel Pipeline Option (Collocated Pipeline Option) would add the 14-inch-diameter natural gas pipeline proposed under Alternative 2 to Alternative 3B. Under this option, the power plant would operate primarily on natural gas instead of diesel as proposed under Alternative 3B. The diesel pipeline would deliver the diesel that would be supplied using river barges under Alternative 2 and because it would not be supplying the power plant, could be reduced to an 8-inch-diameter pipeline. The two pipelines would be constructed in a single trench that would be slightly wider than proposed under either Alternative 2 or Alternative 3B and the work space would be five feet wider. The permanent pipeline ROW would be approximately two feet wider. This option could be configured with either the Tyonek or Port MacKenzie dock options.

This action would eliminate all barge traffic necessary to transport diesel fuel to the Mine Site. As shown in the following table, without fuel barging, project related barging activity would be 64 round trips per year (for cargo only) compared to 122 barge trips under Alternative 2 (Table 3.21-29).

Table 3.21-29: Annual River Barge Traffic During Operations: Alternatives 2 and 3B

	Number of Round Trips Per Season	
	Alternative 2	**Alternative 3B**
Estimated Baseline[1]	68	68
Project-related Cargo[2]	64	64
Project-related Fuel[3]	58	0
Total Project-related	**122**	**64**

Notes:
1 Current barge traffic typically consists of one or two 40-ft by 160-ft barges with a pusher tug.
2 Cargo tows would be composed of a tug pushing four barges. Each cargo barge would be 44 ft wide and 150 ft long.
3 Fuel tows would be composed of a tug pushing four double-hulled barges. Each fuel barge would be 44 ft wide and 165 ft long.
Project-related quantities represent peak years

Source: SRK 2013a; Michael Baker Jr. 2013a

3.21.6.5.1 TRANSPORTATION CORRIDOR

The reduction in river barge tow frequency under Alternative 3B would reduce disturbance to subsistence fish and wildlife resources and reduce disturbance and displacement to access to subsistence fishing and hunting areas along the Kuskokwim River corridor, compared to Alternative 2. Estimated barge tows would total 64 round trips or 128 one-way trips per season, which would yield an average of just over 1 to 1.5 passings per day during the 110-day season. This would represent intervals of about 16 to 24 hours between passings. The reduction in barge tow disturbance would reduce the need for subsistence fishers in affected reaches of the river to redirect their effort to alternative locations, resulting in a lower intensity of impacts on subsistence fishing. Impacts from competition and socio-cultural changes would be similar to those in Alternative 2, except that river barge employment and income may be reduced, and ocean barge employment and income may increase to transport diesel to the Tyonek North Forelands Facility.

The diesel tanker traffic to the modified Tyonek North Forelands Facility would increase the potential for disturbance or collisions, but the occurrence of marine mammals in that area is low (Section 3.12, Wildlife). As a result, impacts to marine mammal hunting by Tyonek residents are estimated to be limited, resulting in little need to redirect subsistence harvest effort to alternative times and places. Subsistence salmon fishing occurs along shore north and south of the existing Tyonek North Forelands Facility (see Stanek et al. 2007, Map 2, generalized in Figure 3.21-57). Under Alternative 3B, the new dock and berth would be extended to deeper water to accommodate deeper draft vessels. As a result, the vessels would be further from shore and less likely to interfere with subsistence fishing, by comparison to the existing dock and berth configuration (see Figure 2.3-39). If Port MacKenzie were used instead of the modified Tyonek North Forelands Facility, there would be no effect on subsistence hunting for beluga whales or on subsistence fishing.

3.21.6.5.2 PIPELINE

Under this alternative, changes in competition would be much larger than under Alternative 2. Portions of the temporary gravel access roads developed during Pipeline Construction would be left in place to provide increased spill response capabilities during Operations. This alternative would require additional airstrips and staging areas for Pipeline Construction, and most of the airstrips would need to be left in place throughout the operating life of the Pipeline for diesel spill response capacity. There would be three existing and nine temporary new airstrips for Construction under Alternative 2, and Figure 2.3-27 shows the locations (see Chapter 2, Alternatives). For Alternative 3B, there would be 30 airstrips for diesel pipeline spill response. This list for Alternative 3B includes the airstrips used in Construction of Alternative 2, plus three new airstrips: Puntilla at MP 108, Tatlawiksuk at MP 220, and George River at MP 276. In addition, for Alternative 3B, the list of airstrips for spill response includes 14 existing airstrips, most of them in communities within the EIS Analysis Area, such as Tyonek, Skwentna, Nikolai, McGrath, Red Devil, and Aniak. The 12 new airstrips (nine used in Construction under Alternative 2, and 3 proposed for installation under Alternative 3B) represent many new points of potentially long-term access, some of which fall in or near documented subsistence use areas.

The following community subsistence use areas may be affected by the proximity of the associated airstrips and gravel access roads retained after Construction:

- Skwentna - MP 42 Deep Creek airstrip and MP 54 Shell airstrip
- McGrath, Nikolai, and Takotna – MP 158 Farewell airstrip (as in Alternative 2)
- Central Kuskokwim villages – MP 235 Kuskokwim East airstrip and MP 246 Kuskokwim West airstrip
- Crooked Creek – MP 276 George River airstrip

Based on the availability of access from the airstrips remaining in operation, the level of use and resulting competition by non-local hunters would be greater and longer lasting (during the operational life of the diesel pipeline) than under Alternative 2. Changes in competition for resources in limited abundance may result in noticeable reduction in harvest success (up to 25 percent).

In addition, the twice monthly helicopter surveillance flights along the diesel pipeline could potentially disturb wildlife and interfere with subsistence hunting activities.

Port MacKenzie Option

As discussed in Section 2.3.4, Alternatives, this Alternative also contains a Port McKenzie Option that would depart from the diesel pipeline route at approximately MP 28 and head east-southeast to an intersection with Ayshire Road. The Pipeline would then route to Port Mackenzie instead of the Tyonek North Forelands Facility. Under this option, the impacts associated with the North Forelands Facility would be eliminated.

Collocated Natural Gas and Diesel Pipeline Option (Collocated Option)

As discussed in Section 2.3.4, Alternatives, this Alternative also contains an Option for a collocated diesel and natural gas pipeline. The impacts for the Collocated Option would be the same as Alternative 3B.

3.21.6.5.3 SUMMARY OF IMPACTS - ALTERNATIVE 3B

Mine Site: The estimated impacts from the Mine Site are the same as in Alternative 2, as the footprint and activity levels remain the same.

Transportation Corridor: With elimination of fuel river barge tows, total project-related barge traffic would be 64 round trips compared to 122 under Alternative 2. As a result, the level of disturbance to subsistence fishing access along the Kuskokwim River would lower than that of Alternative 2 and would reduce the need to alter the timing or redirect fishing effort to alternative areas less affected by barge traffic. Diesel tanker traffic at the modified Tyonek North Forelands Facility was estimated to result in little effect on beluga whale harvesting or on subsistence salmon fishing. Use of Port MacKenzie as the diesel fuel transfer point would eliminate the impacts on beluga whale hunting and subsistence salmon fishing.

Pipeline: The diesel pipeline in Alternative 3B would be buried and would occupy the same ROW as the natural gas pipeline in Alternative 2. However, additional airstrips and staging areas would be required for construction, and in Contrast to Alternative 2, most of the construction airstrips and access routes to the ROW would be left in place to support spill response. These airstrips would represent many new points of potentially long-term access, some of which fall in or near documented subsistence use areas, and would contribute to a likely higher level of competition than would occur under Alternative 2. The diesel pipeline would also require more intensive monitoring, by twice monthly helicopter surveillance flights, with the potential to disturb wildlife and subsistence users near the ROW.

All Components: As with Alternative 2, the duration of effects would be the life of the project and would extend along the Kuskokwim River barging corridor and the pipeline ROW. The context of the affected resources would include effects on Chinook salmon and moose, resources for which urgent conservation measure have been adopted in recent years.

Impacts associated with climate change would also be greater than those for Alternative 2. Burning diesel rather than natural gas at the electrical generating power plant would increase emissions of greenhouse gases (see Section 3.8.3.5 Air Quality), while the decrease in barging would slightly reduce contributions to greenhouse gasses. These effects determinations take into account applicable impact reducing design features, and BMPs and standard permit conditions as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

3.21.6.6 ALTERNATIVE 4 – BIRCH TREE CROSSING (BTC) PORT

Under Alternative 4, the upriver port site would be located at BTC, 124 river miles upstream from Bethel, 14 river miles below Aniak, and 75 river miles below the Angyaruaq (Jungjuk) Port site. The Mine Site and Pipeline components would be the same as those in Alternative 2, and the impacts of those two project components would be the same as in Alternative 2.

Transportation Corridor: Under Alternative 2, the distance travelled by barges along the river to BTC would be 124 miles, rather than 199 river miles under Alternative 2. The number of river barge trips would be the same at 122 round trips annually. Importantly, the Kuskokwim River narrows upstream from Aniak, so the BTC port would eliminate barging in the narrow and shallow segments near Aniak and the Oskawalik River. The road from BTC to the Mine Site

would be approximately 76 miles long, compared to 30 miles for the mine access road from Angyaruaq (Jungjuk) (see Table 3.21-30 below).

Table 3.21-30: Annual Transportation Distances: Alternatives 2 and 4

	Alternative 2 – River/Road Miles	Alternative 4 – River/Road Miles	Difference in River/Road Miles
Barge	199	124	-75
Mine Access Road	30	76	+46

Alternative 4 substitutes the effects of the reduced river transportation distance for the potential effects from a longer mine access road. Effects of reduced river barge transportation distance include reduced disturbance of subsistence resources and access along the Kuskokwim River, and specifically avoidance of subsistence fishing disturbance in the shallow and narrow reaches near Aniak and the Oskawalik River.

The mine access road from the BTC Port site would cross the Owhat River watershed, which is reported to be an important area for subsistence activities by residents from several communities (URS 2014e). The BTC mine access road would cross subsistence use areas for Aniak and Chuathbaluk, as well as other Central Kuskokwim River communities. As shown in Figure 3.21-60, Figure 3.21-62, and Figure 3.21-63, many Central Kuskokwim River communities hunt for moose, black bear, and waterfowl, and pick berries and plants along the river corridor, including the area affected by the BTC Port and early portion of the mine access road.

In response to comments on the Draft EIS, subsistence use area maps for moose, black bear, caribou, vegetation and berries, furbearers, and waterfowl for Aniak and Chuathbaluk were reviewed. These communities use large areas north of the Kuskokwim River, traversed by the BTC mine access road. Spatial overlaps with the BTC road were identified for Aniak and Chuathbaluk fall moose hunting and late summer / fall berry picking use areas (Figure 3.21-76, Figure 3.21-77). These activities take place during the shipping season when truck traffic on the BTC road would occur frequently.

Aniak residents' moose hunting occurs in a very large area, along the mainstem of the Kuskokwim River from Upper Kalskag to Georgetown, up the Aniak River, and within a large zone between the Kuskokwim and Yukon rivers. Much of the hunting in this area is beyond the reach of boat access and is supported by aircraft. The Aniak moose hunting activity north of the Kuskokwim River overlaps the mine access road from the BTC Port to north of the Horn Mountains.

For Chuathbaluk residents, the moose hunting area is smaller than that of Aniak residents, and includes the mainstem of the Kuskokwim River from Upper Kalskag to about the Oskawalik River, on Victoria Creek and the Holokuk River south of the Kuskokwim, and on the Kolmakof River and a zone around the Russian Mountains north of the Kuskokwim. The use area around the Russian Mountains overlaps with the mine access road for about ten miles north and west of the Russian Mountains.

For berry picking and vegetation gathering, the Aniak use area includes a small area north of the Kalskags, a large zone around Whitefish Lake, down the Aniak River to above the

confluence with the Salmon River, a more confined area north of the Kuskokwim River (by comparison to the moose hunting area) and an area along the main tem of the Kuskokwim from Napaimute to just above the Angyaruaq (Jungjuk) Port, and an area overlapping and north of the Mine Site. The area north of the Kuskokwim River would overlap with the BTC road from just above the port to a point north of the Russian Mountains.

The Chuathbaluk use area for berries and vegetation is also extensive, though smaller than that of Aniak residents. It includes the mainstem of the Kuskokwim from Upper Kalskag to about Sutter Creek, another segment from above the Holokuk to the Oskawalik River, and a zone along the Owhat River and surrounding the Russian Mountains. The overlap with the BTC road would occur in the middle reaches of the Owhat River and north and west of the Russian Mountains.

Except at the port, there was no overlap for black bear hunting and waterfowl harvest areas (Figure 3.21-78) for Aniak and Chuathbaluk with the BTC Road. Aniak residents' trapping area included a large area around the Owhat River and north and west of the Russian Mountains. Trapping would occur during the winter, when the road is inactive.

In addition to the impacts noted above, fugitive dust from the traffic on the BTC mine access road would affect berrypicking resources adjacent to the road, similar to the finding for the Angyaruaq (Jungjuk) mine access road in Alternative 2. The BTC mine road might increase access and competition with existing subsistence users in areas along the road corridor after closure. However, since this road is not connected to any villages, it would require boat access and then use of an OHV and likely levels of increase are expected to be small.

In regard to the intensity of effects, the mapped overlap of Aniak and Chuathbaluk moose hunting and berrypicking areas with the BTC road affects a small proportion of the total use areas for these resources. The BTC Port site and adjacent river corridor would overlap with a small portion of the moose and black bear hunting, berry picking, and waterfowl hunting areas for other Central Kuskokwim River communities. The BTC Port site would also displace set net and drift net fishing locations opposite the downstream mouth of Aniak Slough (Figure 3.21-66A), while avoiding barging through the Aniak and Oskawalik shallow, narrow areas upriver of BTC. Generally, subsistence uses could be redirected to other unaffected portions of the subsistence use areas for these resources at modest cost and additional effort.

The effects of the longer mine site road and the BTC Port on habitat that supports subsistence activities would extend beyond the life of the project and after Closure, since the port and mine access road would be maintained indefinitely to support monitoring efforts and eventual operation of a Water Treatment Plant at the pit lake. Upon Closure, access to subsistence resources would increase, since vehicle traffic on the road would be very limited and disturbance to subsistence resources and uses would decline to nearly baseline conditions.

Mine Site and Pipeline: Direct and indirect effects on subsistence uses from changes in subsistence resources and access in the vicinity of the Mine Site and along the Pipeline would be the same as in Alternative 2, since there would be no change in these project component footprints and activities under Alternative 4.

All Components: Impacts due to competition for resources and sociocultural effects from employment, income, out-migration and rotational shift work would be the same as Alternative 2. Except as noted above regarding the port and mine access road, the duration of effects would be the life of the project and the extent would include the Kuskokwim River barging corridor.

The context of the affected resources would include effects on Chinook salmon and moose, resources for which urgent conservation measure have been adopted in recent years. Impacts associated with climate change would also be the same as discussed for Alternative 2. These effects determinations take into account applicable impact reducing design features, and BMPs and standard permit conditions as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

3.21.6.7 ALTERNATIVE 5A – DRY STACK TAILINGS

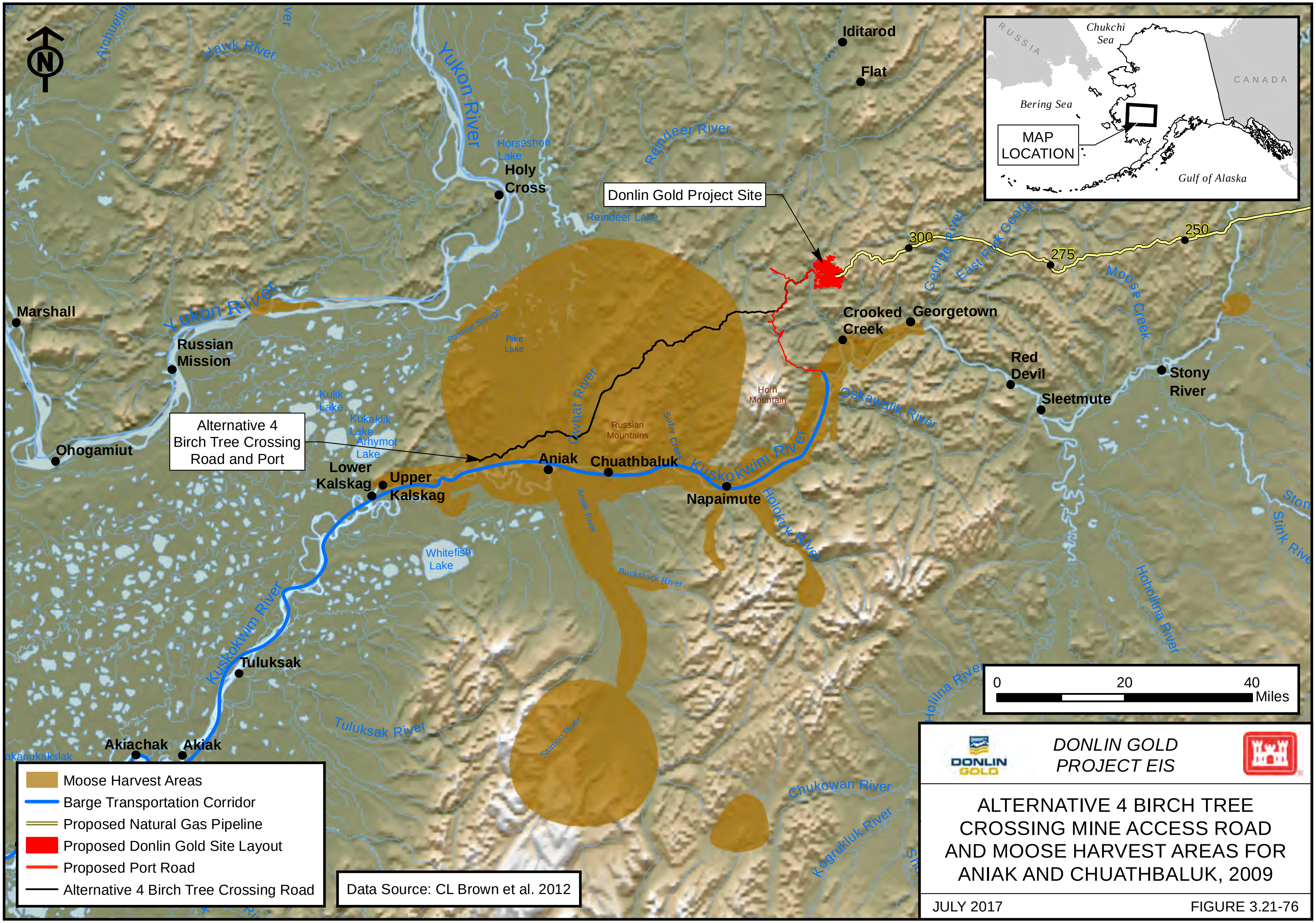
Mine Site: By substituting dry stack tailings (DST) and a water retention facility for subaqueous tailings in the Tailings Storage Facility, Alternative 5A would result in a different set of environmental risks and benefits, as well as operational challenges as noted in Section 2.3.6.1. In Alternative 5A, the tailings would be deposited as partially saturated, compactable filter cake, which adds an additional margin of safety in reducing risk of tailings spill. An operating pond would also be required, which would add to the footprint of Alternative 5A and entail risk of dam failure. The primary objective of the dry stack process is to reduce the potential spill risk for tailings water escaping the tailings storage facility. Spill risk and consequences are analyzed in Section 3.24, Spill Risk.

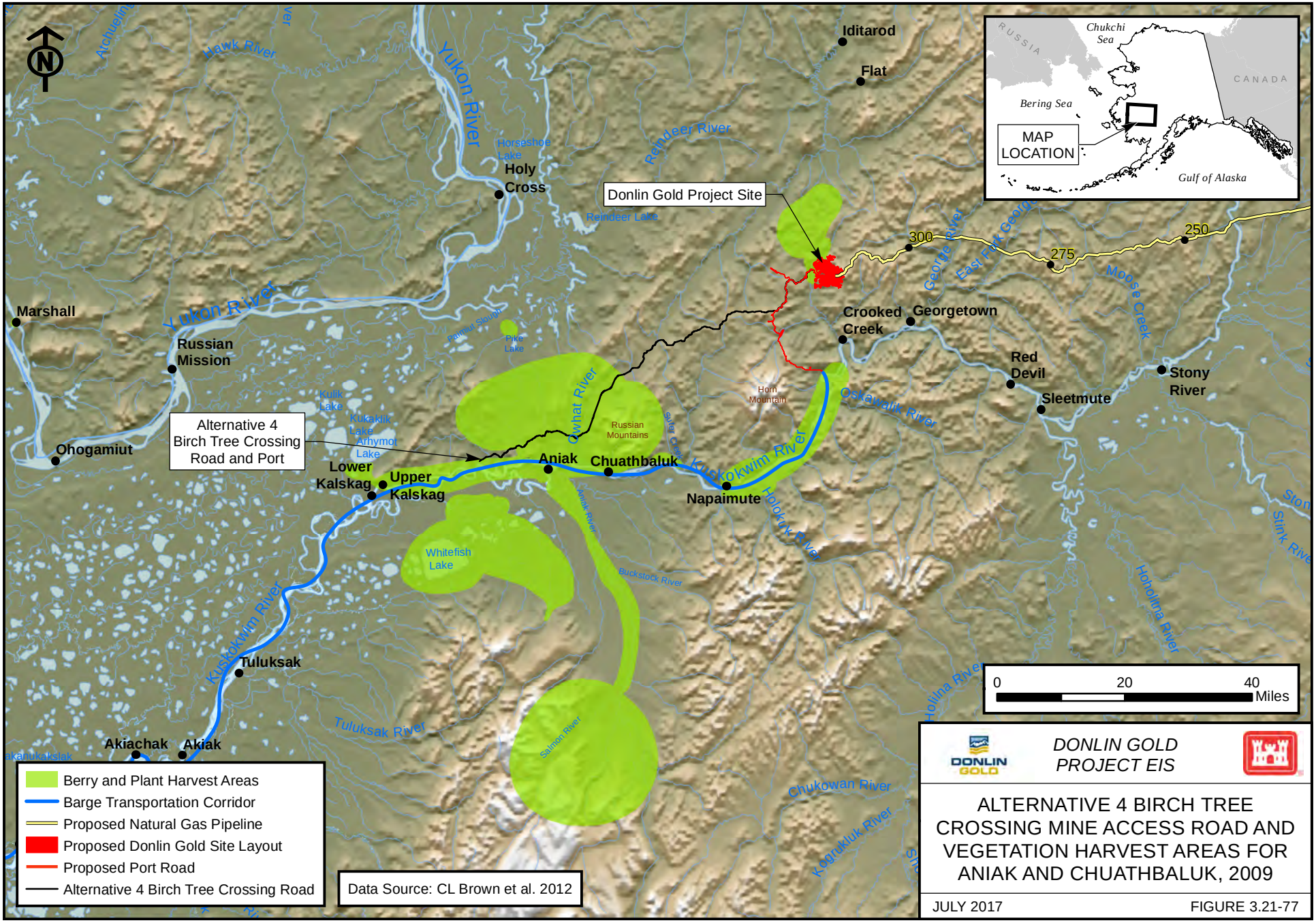
Under routine operations, Alternative 5A would have the similar direct and indirect effects on subsistence resources, access, competition, and sociocultural practices as Alternative 2. Groundwater considerations are evaluated in Section 3.6, Groundwater Hydrology.

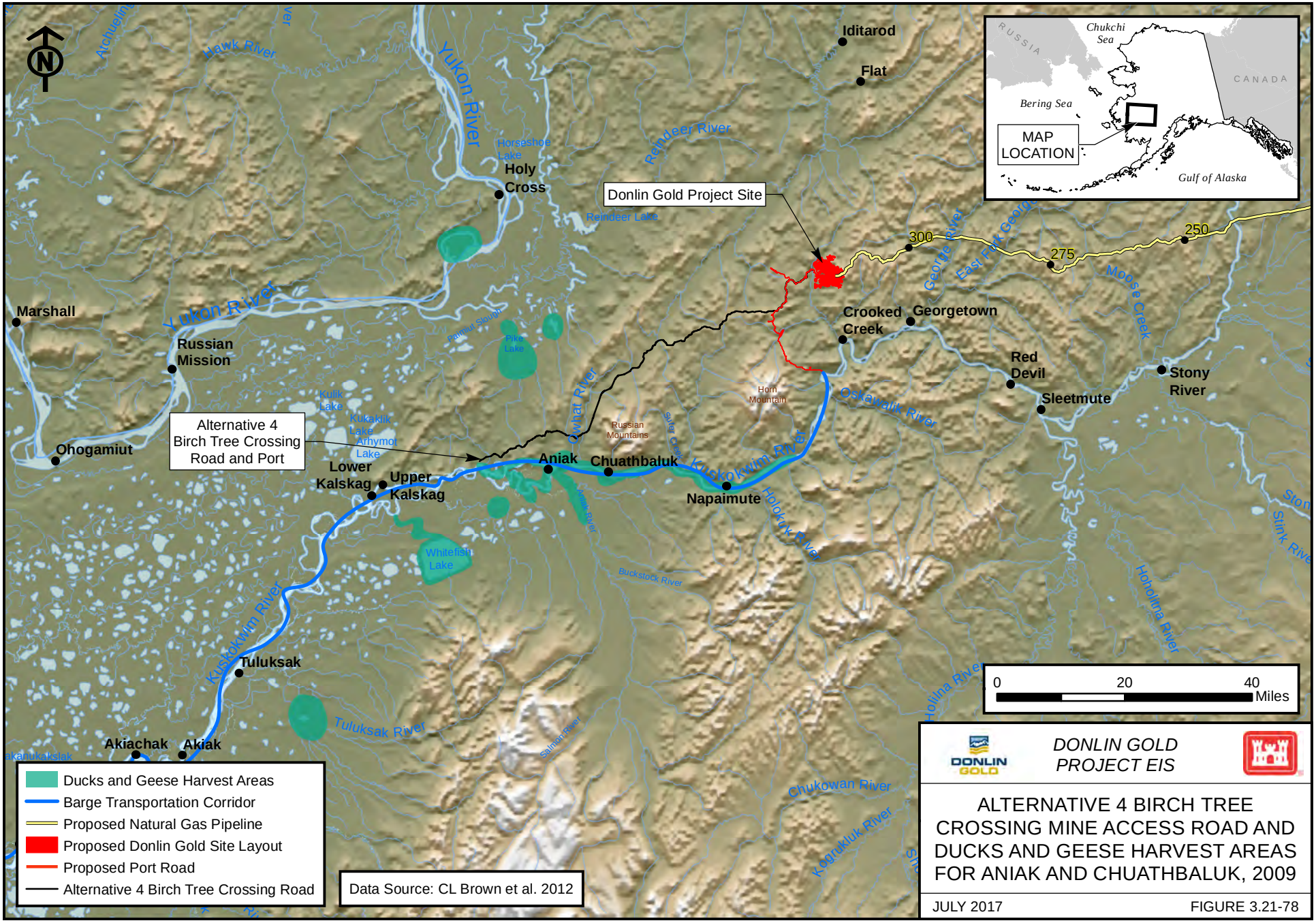
As described in the Wildlife Section, Section 3.12, subsection 3.12.3.6, the footprint of the Mine Site TSF would be increased to 2,463.0 acres for the Unlined Option (71.6 acre increase), and increased to 2,753.5 acres for the Lined Option (362.1 acre increase), compared to 2,391.4 acres in Alternative 2. The use of DST which may slightly reduce potential use of water containment facilities by waterfowl as there is expected to be less open water areas during Operations.

Transportation Corridor and Pipeline: Direct and indirect effects on subsistence uses from changes in subsistence resources and access in the vicinity of the Transportation Corridor and Pipeline would be the same as in Alternative 2, since there would be no change in these project component footprints and activities under Alternative 5A.

All Components: Impacts due to competition for resources and sociocultural effects from employment, income, out-migration and rotational shift work would be the same as Alternative 2. The duration of effects would be the life of the project and the extent would include the Kuskokwim River barging corridor. The context of the affected resources would be limited to commonplace resources in the vicinity of the Mine Site. Impacts associated with climate change would also be the same as discussed for Alternative 2. These effects determinations take into account applicable impact reducing design features, and BMPs and standard permit conditions as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.


Iditarod
Flat
Holy Cross
Marshall
Russian Mission
Ohogamiut
Lower Kalskag
Upper Kalskag
Aniak
Chuathbaluk
Napaimute
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Tuluksak
Akiachak
Akiak
Yukon River
Kuskokwim River
Donlin Gold Project Site
Alternative 4 Birch Tree Crossing Road and Port
300
275
250
Russian Mountains
Horn Mountain
Whitefish Lake
Chukchi Sea
RUSSIA
CANADA
Bering Sea
Gulf of Alaska
MAP LOCATION
0
20
40
Miles
Moose Harvest Areas
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Data Source: CL Brown et al. 2012
DONLIN GOLD
DONLIN GOLD PROJECT EIS
ALTERNATIVE 4 BIRCH TREE CROSSING MINE ACCESS ROAD AND MOOSE HARVEST AREAS FOR ANIAK AND CHUATHBALUK, 2009
JULY 2017
FIGURE 3.21-76


Iditarod
Flat
Holy Cross
Horseshoe Lake
Reindeer River
Reindeer Lake
Donlin Gold Project Site
Yukon River
Hawk River
Marshall
Russian Mission
Pilot Station
Pike Lake
Kulik Lake
Kukaklik Lake
Arhymot Lake
Ohogamiut
Alternative 4 Birch Tree Crossing Road and Port
Lower Kalskag
Upper Kalskag
Aniak
Chuathbaluk
Kuskokwim River
Napaimute
Holokuk River
Oskawalik River
Crooked Creek
Georgetown
George River
East Fork George
Moose Creek
Red Devil
Sleetmute
Stony River
Horn Mountain
Russian Mountains
Swift Creek
Aniak River
Buckstock River
Whitefish Lake
Tuluksak
Tuluksak River
Akiachak
Akiak
Salmon River
Holitna River
Stink River
Hoholitna River
Chukowan River
Kogrukluk River
300
275
250
RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
0
20
40
Miles
Berry and Plant Harvest Areas
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Data Source: CL Brown et al. 2012
DONLIN GOLD
DONLIN GOLD PROJECT EIS
ALTERNATIVE 4 BIRCH TREE CROSSING MINE ACCESS ROAD AND VEGETATION HARVEST AREAS FOR ANIAK AND CHUATHBALUK, 2009
JULY 2017
FIGURE 3.21-77


Iditarod
Flat
Holy Cross
Horseshoe Lake
Reindeer River
Reindeer Lake
Yukon River
Hawk River
Donlin Gold Project Site
300
275
250
George River
East Fork George
Moose Creek
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Oskawalik River
Marshall
Russian Mission
Yukon River
Pilot Station
Pike Lake
Kuilik Lake
Kukaklik Lake
Arhymot Lake
Ohogamiut
Alternative 4 Birch Tree Crossing Road and Port
Lower Kalskag
Upper Kalskag
Aniak
Chuathbaluk
Kuskokwim River
Napaimute
Holokuk River
Horn Mountain
Russian Mountains
Salt Creek
Aniak River
Whitefish Lake
Buckstock River
Stink River
Hoholitna River
Tuluksak
Tuluksak River
Salmon River
Akiachak
Akiak
Chukowan River
Kogrukluk River
Ducks and Geese Harvest Areas
Barge Transportation Corridor
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Alternative 4 Birch Tree Crossing Road
Data Source: CL Brown et al. 2012
MAP LOCATION
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
0
20
40
Miles
DONLIN GOLD
DONLIN GOLD PROJECT EIS
ALTERNATIVE 4 BIRCH TREE CROSSING MINE ACCESS ROAD AND DUCKS AND GEESE HARVEST AREAS FOR ANIAK AND CHUATHBALUK, 2009
JULY 2017
FIGURE 3.21-78

3.21.6.8 ALTERNATIVE 6A – MODIFIED NATURAL GAS PIPELINE ALIGNMENT: DALZELL GORGE ROUTE

Pipeline: For the Pipeline component, Alternative 6A would follow an alternative alignment in the Alaska Range, from about MP 107 to MP 152. Since this is well outside of the subsistence use area of Skwentna, the closest community, this variation in alignment would not change the subsistence impacts identified for the Pipeline under Alternative 2.

Mine Site and Transportation Corridor: The potential direct and indirect impacts to subsistence resources and uses during Construction, Operations, and Closure under Alternative 6A would be the same as those described under Alternative 2.

All Components: Impacts due to competition for resources and sociocultural effects from employment, income, out-migration and rotational shift work would be the same as Alternative 2. The duration of effects would be the life of the project and the extent would include the Kuskokwim River barging corridor. The context of the affected resources would be limited to commonplace resources along the Pipeline.

Impacts associated with climate change would also be the same as discussed for Alternative 2.

The effects determinations take into account applicable impact reducing design features, and BMPs and standard permit conditions as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

3.21.6.9 ALTERNATIVES IMPACT COMPARISON

Information regarding species harvested by edible weight, per capita subsistence production and estimated annual pounds per capita harvested, and use areas provided in Table 3.21-31 to aid the reader in comparison of subsistence harvests in the Project Area. A comparison of these impacts to subsistence by alternative is presented in Table 3.21-32.

Table 3.21-31: Comparison of Subsistence Harvests

	Cook inlet Tyonek (2006)	Upper Kuskokwim Nikolai (2011)	Central Kuskokwim Crooked Creek[1] (2008)	Lower Mid-Kuskokwim Bethel[2] (2012)	Lower Kuskokwim Quinhagak (2013)	Bering Sea Coast Scammon Bay (2013)	Mouth of the Yukon Emmonak (2008)	Lower Yukon Russian Mission (2011)	Middle Yukon Grayling (2011)
Top 10 species and percent of total harvest by edible weight	Chinook salmon – 42% Moose – 14% Coho salmon – 13% Sockeye salmon 13% Eulachon – 6% Blueberry – 3% Highbush cranberry – 2% Harbor seal – 1% Rainbow trout – 1% Pink salmon – 1%	Moose – 47% Chinook salmon – 18% Northern pike – 5% Coho salmon – 4% Sheefish – 4% Chum salmon 3% Humpback whitefish – 3% Black bear – 2% Beaver – 2% Bering cisco 1%	Chinook salmon – 28% Chum salmon – 20% Coho salmon – 13% Sheefish – 9% Sockeye salmon – 8% Moose – 7% Beaver – 3% Black bear – 3% Crowberry – 2% Blueberry – 1%	Moose – 21% Chum salmon – 12% Coho salmon – 11% Sockeye salmon – 10% Chinook salmon – 8% Northern pike – 6% Caribou – 5% Unknown smelt – 3% Humpback whitefish - 3% Cloudberry – 2%	Chinook salmon - 19% Moose – 10% Caribou – 7% Sockeye salmon – 6% Chum salmon – 5% Coho salmon – 4% White-fronted goose – 4% Crowberry – 4% Cloudberry – 4% Pacific halibut – 3%	Moose – 19% Summer chum salmon – 17% Beluga whale – 9% Pacific halibut – 8% Bearded seal – 4% Saffron cod – 4% Ringed seal – 4% Pacific herring – 4% Cloudberry – 3% Northern pike – 3%	Chum salmon – 26% Moose – 26% Chinook salmon – 8% Sheefish – 6% Bearded seal – 5% Beluga – 5% Coho salmon – 4% Burbot – 2% Northern pike – 2% Broad whitefish – 1%	Moose – 31% Chinook salmon – 22% Arctic lamprey – 8% Summer chum salmon – 7% Northern pike – 7% Humpback whitefish – 4% Sheefish – 3% Burbot – 3% Fall chum salmon – 2% Coho salmon – 2%	Chinook salmon – 27% Moose – 24% Summer chum salmon – 12% Beaver – 6% Fall chum salmon – 5% Broad whitefish – 5% Sheefish – 5% Coho salmon – 4% Humpback whitefish – 2% Northern pike – 2%
Per Capita Subsistence Production: Estimated annual pounds per capita	Tyonek: 170 pounds Range from 161 in Skwentna to 204 pounds in Beluga	Nikolai: 499 pounds Range from 162 pounds in Takotna to 936 in Lime Village	Crooked Creek: 245 pounds Range from 187 in Lower Kalskag to 533 in Stony River	Range from 166 in Bethel, to 1,328 for Akiachak	Quinhagak: 295 pounds Range from 244 in Eek to 361 for Tuntutuliak	Scammon Bay: 417 pounds	Emmonak: 482 pounds Range from 482 for Emmonak to 1,393 for Nunam Iqua	Russian Mission: 329 Range from 158 to for Pilot Station to 393 for Marshall	Grayling: 246 pounds Range from 246 for Grayling to 634 for Holy Cross
Subsistence Use Areas: Estimated square miles	Tyonek: 254 square miles	Nikolai: 757 square miles	Crooked Creek: 1,246 square miles	Bethel: 17,786 square miles Kwethluk: 6,379 square miles	Quinhagak: 8,495 square miles	Scammon Bay: 6,625 square miles	Emmonak: 6,111 square miles	Russian Mission: 987 square miles	Grayling: 1,164 square miles

Table 3.21-32: Comparison of Impacts by Alternative* for Subsistence

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Direct or Indirect Impacts						
Mine Site	During Construction and Operations, disturbance to subsistence resources and displacement of subsistence harvest activities would be limited to small portions of the subsistence use areas of Crooked Creek and Aniak residents for black bear, furbearers, waterfowl, and berries. Bering Sea coast uses of migratory waterfowl could be affected by concerns over contamination at the Mine Site (however, biological analysis indicates the risk to wildlife and birds from chemical exposure in the pit is unlikely or low). Alternative harvest areas are available at low cost and effort, resulting in little reduction in harvest levels. The project would result in very little direct new competition for subsistence resources, due to policies and the enclave model of development. However, increased employment and incomes may increase subsistence activities and indirectly increase historic forms of competition among regional residents for resources such as Chinook salmon and moose. Sociocultural impacts from project employment and income would include improved support for subsistence equipment and transportation costs, affecting 25-29 percent of EIS Analysis Area households during Construction, and 5-9 percent of households during Operations. Project employment may stabilize employed households, but about half of employed household may migrate out of the EIS Analysis Area. About half of employed households are estimated to see the flexibility of rotating shift work as a benefit, while half would consider this an adverse effect on subsistence activities. After Closure, disturbance to subsistence resources and uses would greatly diminish, as would the sociocultural effects, both beneficial and adverse, from project employment and incomes. The effects would occur primarily during the 31 years of Construction and Operations. The extent of these effects on subsistence resources and uses would focus on Crooked Creek and Aniak, while the effects of competition would extend to the Kuskokwim River, and sociocultural effects would extend to the EIS Analysis Area, with greater concentration among the Central Kuskokwim River villages near the Mine Site. The context of these affects would generally include resources that are common and widely available, with Chinook salmon and moose the focus of urgent conservation measures in recent years. Migratory waterfowl are protected by the Migratory Bird Treaty Act, and subsistence practices are recognized in the rural subsistence priority of Title VIII of ANILCA. Operation of the mine could result in exposure to mercury, arsenic, and antimony through stack emissions and fugitive dust through the consumption of subsistence foods harvested in the vicinity of the mine. A Human Health Risk Assessment (HHRA) concluded that within a 20-mile radius of the mine, consumption of subsistence resources with the potential to accumulate methyl mercury (northern pike, beaver, mallard, and berries), there could be increased exposure of Crooked Creek residents to mercury.	Same as Alternative 2, because Mine Site footprint and level of activity remain the same.	Same as Alternative 2, because the Mine Site footprint and level of activity would remain the same.	Same as Alternative 2 because the alternative affects the mine access road, addressed under Transportation Corridor, while the Mine Site footprint and level of activity would remain the same.	Generally the same as Alternative 2 because the alternative affects the tailings management at the Mine Site. In the TSF, the Unlined Option would have 2,463 acres of vegetation removed (71.6 more than Alternative 2); the Lined Option would have 2,753.5 acres removed (362.5 more compared to Alternative 2). (2,391.4 would be removed in the TSF in Alternative 2). The risk of potential dam failure and downstream release of slurry materials to Anaconda and Crooked creeks would be reduced from Alternative 2 while the general level of activity would remain the same.	Same as Alternative 2 because the alternative affects the Pipeline component, while the Mine Site footprint and level of activity would remain the same.

Table 3.21-33: Comparison of Impacts by Alternative* for Subsistence

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Mine Site	The results of the analysis concluded that within a 20-mile radius of the mine site, exposure to mercury at baseline and estimated project levels would be below the advisory levels of both the Environmental Protection Agency (EPA) and State of Alaska Environmental Public Health Program. For arsenic, exposure at baseline and estimated project levels are within EPA's acceptable risk management range. The findings of the quantitative HHRA indicated that the small increases in constituent concentrations estimated to occur outside of the Mine Site due to Project-related activities are unlikely to result in unacceptable risks to human populations who would have the highest exposure (i.e., subsistence populations). Based on these findings, other human populations, such as residents in the region, would not be expected to be exposed to unacceptable risk due to exposure to Project-related concentrations of mercury, arsenic, or antimony.					
Transportation Corridor	During Construction and Operations, subsistence resources would be affected by habitat loss in small acreages associated with the port sites, airstrip and mine access road. Limited disturbance from river and ocean barge traffic would affect fish, birds, marine mammals, and terrestrial mammals, with greater effects in the narrow and shallow segments of the river, such as near Aniak and the Oskawalik River. Fugitive dust from vehicle traffic would affect berry resources along the mine access road. Subsistence activities near the mine access road and Angyaruaq/Jungjuk port site would be displaced, affecting residents of Crooked Creek and other Kuskokwim River villages. River barge traffic would intermittently disturb subsistence fishing and moose hunting along the bank, with greater displacement in narrow and shallow segments of the Kuskokwim River near Birch Tree Crossing, Aniak, and Oskawalik River. Redirection to alternative times and place at low expense and effort would result in little change in harvest levels. Effects on competition and sociocultural features of subsistence would be the same as at the Mine Site. Duration, extent, and context would be the same as at the Mine Site.	River barge frequency would be reduced from 122 barge tow round trips under Alternative 2 to 83 under Alternative 3A, due to reduced diesel fuel barging. This would reduce the intensity of impacts to subsistence fish resources and fishing activity, particularly in the narrow and shallow segment of the Kuskokwim River. The estimated average interval between barges would be 12-24 hours, compared to 8 hours under Alternative 2. Redirection to alternative times and place at low expense and effort would result in little change in harvest levels. Effects on other impact assessment factors would be the same as Alternative 2.	River barge frequency would be reduced from 122 barge tow round trips under Alternative 2 to 64 under Alternative 3B, due to elimination of fuel barging. This would reduce the intensity of impacts to subsistence fish resources and fishing activity, particularly in the narrow and shallow segments of the Kuskokwim River. The estimated interval between barges would be 16-24 hours, compared to 8 hours under Alternative 2. Redirection to alternative times and place at low expense and effort would result in little change in harvest levels. The expanded dock near Tyonek to receive diesel tankers would result in small intensity impacts to marine mammals, including beluga whales, because the occurrence of marine mammals in that area is low. Effects on other impact assessment factors would be the same as Alternative 2.	Barging distance would be reduced from 199 river miles to 124 under Alternative 4, avoiding the narrow and shallow segments upstream of Birch Tree Crossing, and reducing potential conflicts with subsistence fishing. The mine access road would increase from 30 miles to 76 miles under this alternative, affecting moose, black bear, waterfowl, and berry picking areas for Aniak and Chuathbaluk residents. Impacts to subsistence fishing would be reduced while habitat loss and disturbance from the mine access road would increase. Redirection to alternative times and place at low expense and effort would result in little change in harvest levels. Effects on other impact assessment factors would be the same as Alternative 2.	Same as Alternative 2, as this alternative would not change the Transportation Corridor component.	Same as Alternative 2, as this alternative would not change the Transportation Corridor component.

Table 3.21-34: Comparison of Impacts by Alternative* for Subsistence

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Pipeline	During the 2.5 years of Construction, 14,100 acres of habitat would be affected along the 316-mile pipeline corridor. Construction activities and noise would affect subsistence resources beyond the pipeline corridor, but would be unlikely to result in reduced abundance. During Operations, the pipeline would be buried, with limited above ground facilities, and temporary construction facilities would be stabilized, recontoured and reclaimed. The ROW would not be fenced, but vegetation in the ROW would be cleared every 10 years to allow for maintenance and visual monitoring. Little effect on resource abundance is expected. After Closure, the brushing of the corridor would cease. The Pipeline corridor overlaps with portions of the subsistence use areas of Crooked Creek, Stony River, McGrath, Nikolai, Skwentna, and Tyonek. Displacement would be greater during Construction and very limited during Operations and Closure. The ROW affects small portions of these subsistence use areas, and alternative areas would be available at low cost and effect, resulting in little change to harvest levels. Increased access for fly-in hunters and trappers at Farewell Airstrip and the ROW to the north and west may lead to a small increase in competition for McGrath and Nikolai subsistence users. For all other impact assessment factors, the effects would be the same at the Mine Site.	Same as Alternative 2, as this alternative would not affect the pipeline component.	Same as Alternative 2, except that retention of airstrips and gravel access roads during operations for spill response capacity would result in greater intensity of competition impacts to Beluga, McGrath, Nikolai, Takotna, Central Kuskokwim villages and Crooked Creek compared to Alternative 2. In addition, operation of the diesel pipeline would require twice monthly helicopter surveillance of the entire pipeline for the operational life. Helicopter overflights could disturb wildlife and interfere with subsistence hunting activity along the pipeline.	Same as Alternative 2, as this alternative would not change the Pipeline component.	Same as Alternative 2, as this alternative would not affect the Pipeline component.	The alternative route segment alternatives would affect other resources, but not subsistence practices.

Notes:
1 Crooked Creek is summarized here because it is closest to the Mine Site of the Donlin Gold Project
2 Bethel is summarized here because it is the largest community within the EIS Analysis Area
*The No Action Alternative would have no new impacts on Subsistence resources.